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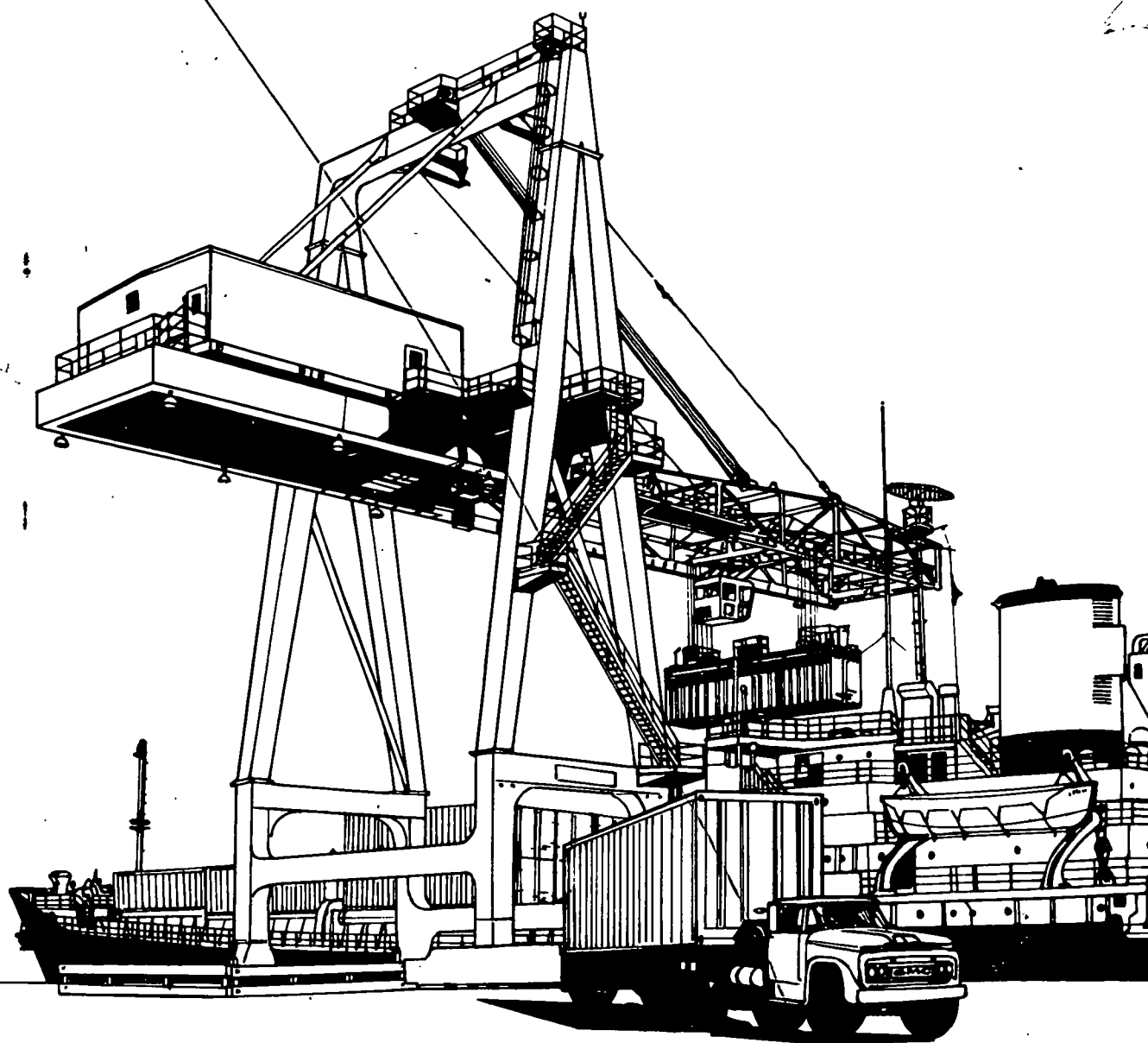
FM 55-70

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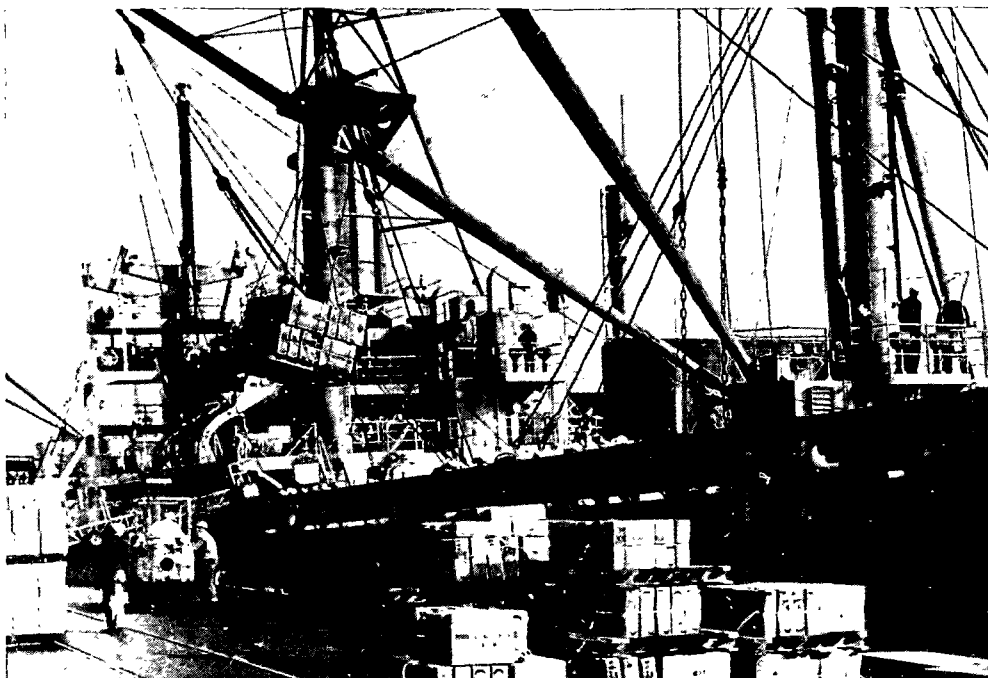
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ARMY TRANSPORTATION CONTAINER OPERATIONS



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7-877

ARMY TRANSPORTATION CONTAINER OPERATIONS

FM 55-70, 17 February 1975, is changed as follows:

1. Significant changes are —
 - a. Chapter 12 is added to reflect information on hazardous materials.
 - b. Appendix F is added to show hazardous cargo labels, and truck and rail placards.
2. Table of contents page is revised to indicate addition of new material.
3. New material is indicated by a star.
4. Remove old pages and insert new pages as indicated below:

Remove pages

i i
12-1 12-1 through 12-14
..... F-1 through F-32

Insert pages

5. File this change sheet in front of the publication for reference purposes.

By Order of the Secretary of the Army:

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PAUL T. SMITH

Major General, United States Army
The Adjutant General

BERNARD W. ROGERS
General, United States Army
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ACTIVE ARMY, ARNG, USAR: To be distributed in accordance with DA Form 12-11B requirements for Army Transportation Services in a Theater of Operations; Transportation Amphibian Operations; Army Terminal Operations.

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 30 September 1976**ARMY TRANSPORTATION CONTAINER OPERATIONS**

FM 55-70, 17 February 1975, is changed as follows:

1. Paragraphs 5-5.1 through 5-5.4 are added to include Teams JB, Cargo Documentation; JC, Freight Consolidation and Distribution; JF, Container Handling—Ship; and JG, Container Handling—Shore.
2. Chapter 7, MARSHALING YARD OPERATIONS, is added in its entirety.
3. New material is indicated by a star.
4. Remove old pages and insert new pages as indicated below:

Remove pages—

5-5 and 5-6

7-1

Insert pages—

5-5 through 5-6.1

7-1 through 7-41

5. File this change sheet in front of the publication for reference purposes.

11/9/76

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FOREWORD

This manual provides commanders, staff officers, and others concerned with general guidance pertaining to transportation container operations in the Army. The manual is intended as interim guidance to serve until operational experience provides a basis for its revision. In using this manual, bear in mind that the discussion of equipment includes a number of items that are not in the Army system but are being considered for development or for procurement from commercial sources. Such developmental action may cause changes in items of equipment that are discussed or pictured in this manual. Also, a number of new terms have been introduced as a result of containerization. These terms are defined in the glossary.

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ELD MANUAL

No. 55-70

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 17 February 1975

ARMY TRANSPORTATION CONTAINER OPERATIONS

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CHAPTER 1

INTRODUCTION

1-1. Purpose and Scope

The purpose of this manual is to—

- Provide doctrinal guidance to personnel engaged in transportation container operations.

This manual covers—

- All phases of military and commercial container transport operations by all transport modes and is applicable without modification to—

Peacetime

Cold war

Limited war

General war

1-2. Recommended Changes

Recommendations for changes to doctrine contained in this manual as a result of operational experience are encouraged and should be submitted to Commandant, US Army Transportation School, ATTN: Deputy Commandant for Combat and Training Developments, Fort Eustis, Virginia 23604. For your convenience, a self-addressed DA Form 2028-1 (Recommended Changes to Publications and Blank Forms) is available in the back of this publication. If this form has been removed, use DA Form 2028.

1-3. Growth of Containerization

Within the transportation industry, the phenomenal growth of containerization is referred to as the container revolution. This occurred primarily in the 1960's and continues today. Carriers engaged in all transport mode operations are investing a larger percentage of their budget in container-related equipment each year. The basic reason for this is the savings in manpower, time, and money inherent in containerization. These savings are accrued by—

Reduced handling	- Less manpower - Less breakage - Less pilferage
Reduced packaging requirements	- Less manpower - Less freight cost - Less time required to prepare shipment

Rapid loading and discharging of equipment	- Less manpower - Faster turnaround - Improved service to customer
Reduced administrative effort	- Less manpower - Less documentation - Less time required to account for cargo - Lends itself to ADP application

Basically, then, containerization has grown within the transportation industry because it is—

- CHEAPER
- FASTER
- MORE EFFICIENT

than shipping by the break-bulk method.

1-4. Early Developments

The first recorded major application of containerized shipment occurred in 1834 when the state of Pennsylvania inaugurated what it called its Main Line of Public Works. An intermodal route connecting the cities of Philadelphia and Pittsburgh, the system consisted of a total of 118 miles of railroad and 276 miles of canal. It required that cargo moving over the entire route be transferred several times between the two modes: rail and water. To overcome the difficulty and inconvenience involved, the canal boats were constructed in detachable segments which could be assembled and disassembled while loaded with cargo. The segments were disassembled for loading and movement by railcar and, after being unloaded from the railcar, were reassembled for further movement by canal.

Containerization was accepted commercially in the early 1900's. However, before 1956 little was done other than to reduce rates for carload and truckload shipments, to transport highway trailers on railcars (piggy-backing), and to palletize cargo.

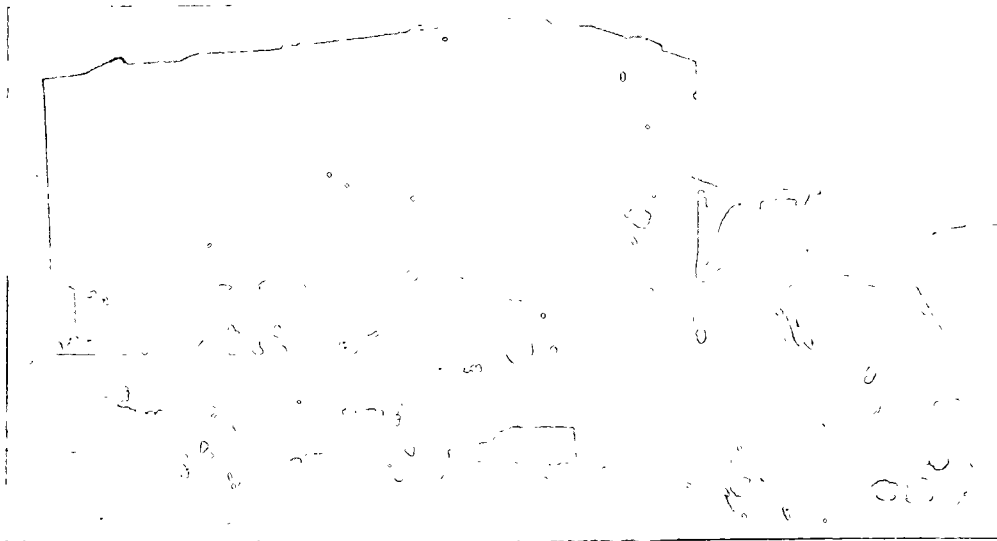


Figure 1-1. Two 'legless' type containers (circa 1920) on a truck. These containers measure 7 feet 2½ inches wide, 9 feet 3½ inches long, and 9 feet 4 1/16 inches high. They have a single door opening in each short side. Capacity is 408 cubic feet or 7,000 pounds; empty weight is 3,020 pounds. Dimensions probably reflect a configuration compatible with container movement by railroad gondola car.



Figure 1-2. Three leg-type "merchandise" containers on a "highway trailer."

CONEX—Forerunner to Commercial Containerization:

The forerunner of commercial containerization—and the first major effort toward any large scale application of containerization—was the Army container express (CONEX). In 1947 the Army purchased 23 experimental type

CONEXes and by mid-1955 had acquired more than 10,000 of these containers. Meanwhile, the Air Force had procured some 5,000 containers of a smaller version of the Army type. By 1967, the CONEX inventory had increased to over 200,000. The real breakthrough in commercial containerization came in the mid-1950's when two US

shiplines engaged in intracoastal trade began carrying containers on spar decks superimposed above the weather deck of tanker vessels. This experimental container service, which operated between New York and Houston, proved the feasibility and practicability of cargo movement by container. As a result, during the period 1957-1958, the same company converted six general cargo ships to container ships. During this period, commercial containerization by ocean carrier also developed in the Alaskan, Hawaiian, and Puerto Rican trade routes where distances between ports were relatively short and on-berth time of ships (break-bulk or container) was a major part of the total voyage time. From these modest beginnings, commercial containerization has progressed rapidly and is changing the entire concept of cargo movement, not only in the maritime industry, but in the entire transportation system as well.

1-5. Current Trends

The growing use of containers in water transport has significantly increased ship productivity, resulting in a decline in shipping costs per measurement ton of cargo. This has resulted in the following trends in the US flag cargo ship fleet:

- Container ships have increased in number from 6 in 1957-58 to over 150 in 1974.
- The majority of cargo ships constructed in the past 5 years, currently on order, or planned are container ships.
- No new break-bulk ships are now being constructed for US registry.
- Approximately 80 freighters in the US flag fleet with a projected service life greater than 25 years are being converted to container ships or partial container ships.

Some worldwide trends are also to be noted:

- Port complexes which are to handle only containers and container ships are being constructed throughout the world.
- There has been a tremendous expansion in development of materials handling equipment, with emphasis on container handling equipment.
- Rail and highway transport operators are placing more emphasis on containerization each year with resultant development of rolling stock and motive power for container operations.

The Ultimate Goal of the Transportation Industry is the Incorporation of Containerization into an Intermodal Transportation System.

1-6. Standardization of Equipment

Standardization of containers and container-

related equipment is being achieved through development and implementation of standardization agreements.

The purpose of standardization is to promote compatibility of containers and container-related equipment within the industry on national and international levels. Standardization is essential to achieving a completely integrated intermodal distribution system.

There are two organizations currently involved in standardization of this equipment:

- *American National Standards Institute (ANSI)*: Primarily standardization of containers and related equipment in the United States.

- *International Organization for Standardization (ISO)*: Establishment of international standards which permit worldwide interchange of containers.

ISO has representatives from more than 50 countries; ANSI is represented in ISO and has representation on the ISO materials handling equipment technical committee.

1-7. Military Use of Containers

What is the impact of the container revolution on the military services? Basically it is that containerization—

- Provides the military the same advantages that it provides commercial shippers and carriers (para 1-3).
- Forces the military to develop techniques to enjoy the benefits of containerization when operating in a hostile environment.
- Requires a new military family of container handling equipment organic to units that handle containers.
- Allows the military to take advantage of new equipment already developed by industry, thus saving substantial research and development funding.
- Promotes the military objective of implementing the following supply distribution concepts:

Inventory in motion
Direct support system
Maximum throughput

1-8. Inventory in Motion, Direct Support System, and Maximum Throughput

The objective of these logistics offensive operations is to—

- Promote rapid resupply response with smaller inventories at supply activities in the combat zone and decreased timelag in the supply line.

- Provide visibility and control of in-transit assets.

The concept is—

- *Limited stockage* in theater.
- *Regulated flow of specific items* from offshore or CONUS.
- A rapid and responsive *resupply* and *transportation system* that permits ready *identification, management, and control of items in transit*.

Movement of cargo by containers promotes—

- *Responsiveness* because of efficiency inherent in container operations.
 - *Identification of items* by relating documentation of items within the container to documentation of the container.
 - *Management and control of items* in transit.
- The Army's *direct support system (DSS)* (DA Pam 700-22) impacts significantly on peacetime container operations by—
- *Increasing supply efficiency, supply responsiveness, and asset visibility.*
 - *Decreasing inventories and timelag in the supply pipeline.*

Basically, the DSS uses high-speed communications for requisitions, in-transit shipment reports, and return-receipt transmission, together

with air (palletized) and sea (containerized) shipments direct from a designated CONUS theater-oriented depot complex to a direct support unit (DSU) or a general support unit (GSU) overseas.

The *DSS is an application of the inventory-in-motion principle*, providing complete *in-transit control and in-transit asset visibility* by transmitting requisitions, supply documents, in-transit data cards, and receipt detail cards through the defense automatic addressing system (DAAS) (or direct) to the logistic control office (LCO), where the data elements become a retrievable part of the logistic information file. When possible, DSS surface shipments are made in full container loads from a single CONUS depot to a single oversea support unit. Otherwise, shipments go to a consolidation containerization point, where shipments from various depots within the complex, addressed to a single DSU or GSU, are consolidated and containerized for shipment overseas.

DSS delivery currently includes—

- Repair parts
- Selected items of clothing and equipment
- Construction materiel
- Missile system components

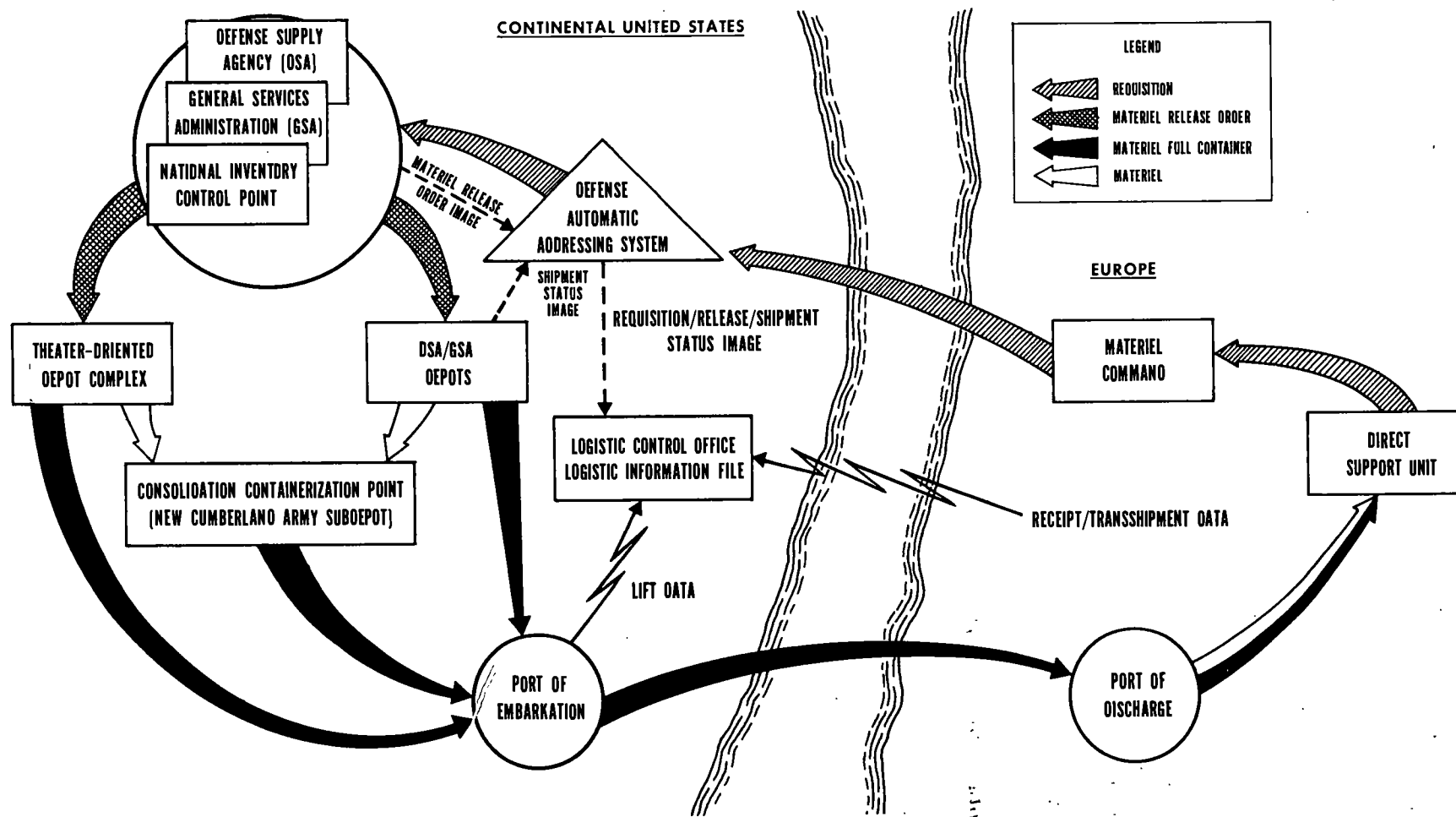


Figure 1-3. Illustrating flow of authorized stockage list requisitions and materiel in the direct support system (Europe).

1-9. Containerization and Throughput

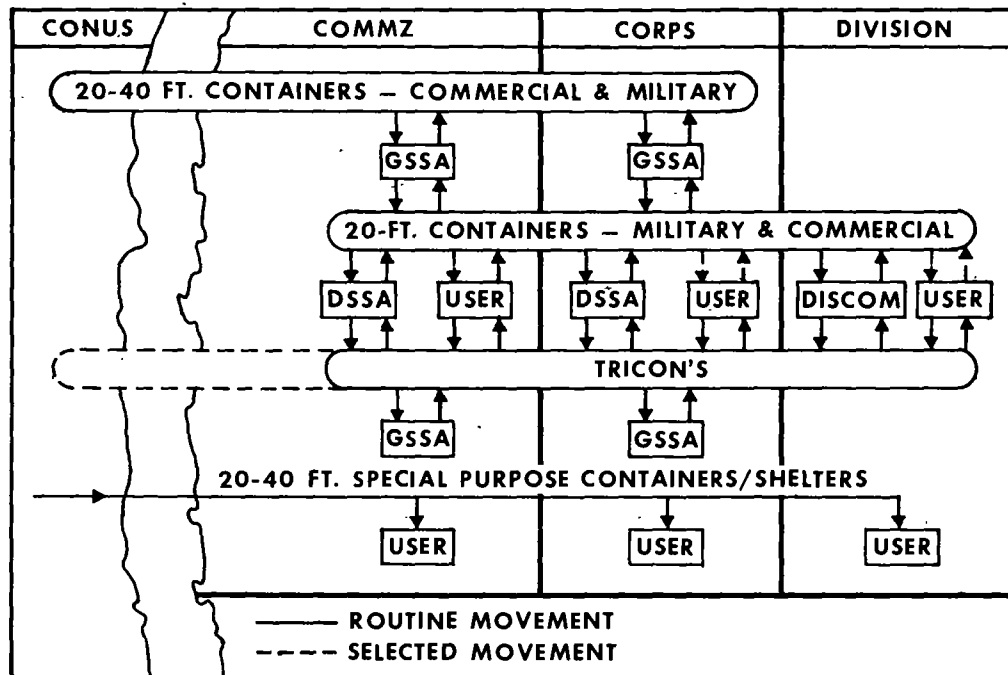


Figure 1-4. Container movement pattern.

As shown in figure 1-4, the intertheater container movement loop employs both commercial and military containers up to 40 feet in length in daily routine shipments from CONUS direct to general support supply activities (GSSA's) in the communications zone (COMMZ) and the corps support areas. The 20-foot containers are used primarily in the intra-theater container movement loops between GSSA's and from GSSA's to direct

support supply activities (DSSA's) and division support commands (DISCOM's). TRICON's and containers with high priority cargo and intensively managed high cost items are shipped from CONUS direct to DSSA's and DISCOM's. Special purpose containers and containerized shelters are shipped from CONUS direct to the user.

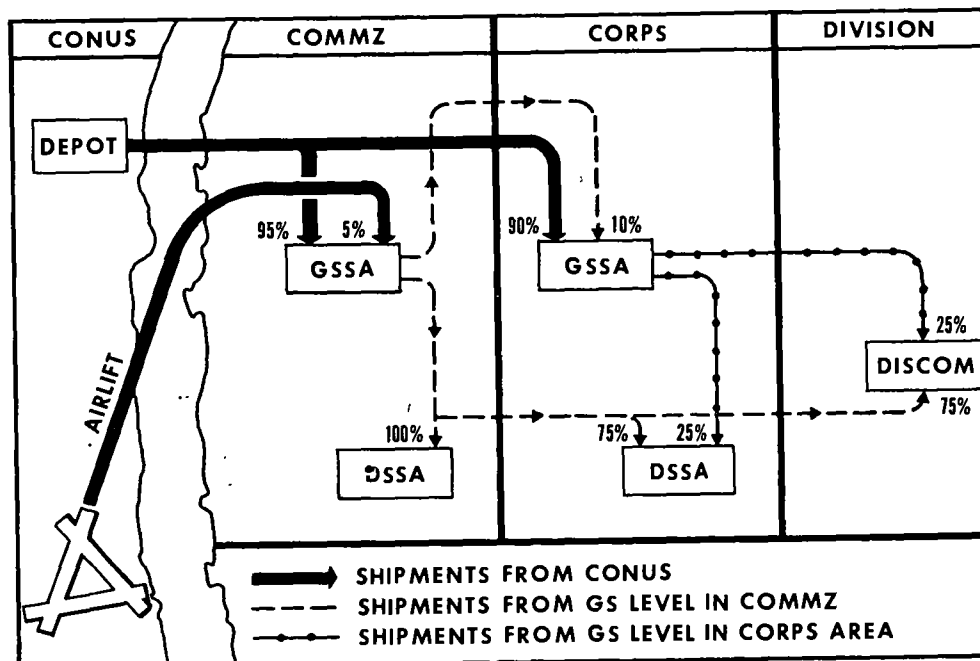


Figure 1-5. Supply flow pattern. This schematic shows the normal supply pattern in a mid-intensity conflict or in a situation where transportation networks impose limitations on container distribution.

The schematic of supply flow shown in figure 1-5 indicates that—

- DISCOM's receive approximately 75 percent of their supply requirements by throughput shipments from COMMZ; the other 25 percent from supporting GSSA's in the corps support areas.¹

- DSSA's in corps support areas receive approximately 75 percent of their support requirements by throughput shipments from the COMMZ or base areas; the other 25 percent from GSSA's located in their area.¹

- DSSA's in the COMMZ receive approximately 100 percent of their support from GSSA's located in the COMMZ.¹

- GSSA's in the corps support area or COMMZ receive approximately 90 to 95 percent of their requirements by direct container shipment from CONUS.

Containerization provides a viable, flexible, and extremely efficient method of meeting these requirements because—

- Once individual items of supply are stowed in the container, they are not handled until the container arrives at a support area break-bulk point or at final destination.

- If transfer is required from one mode of transportation to another, the entire shipment is transferred in one lift, thus reducing handling and chances of damage or pilferage.

The volume of throughput may very well place a strain on main supply routes (MSR's) of the transportation modes. In order to assure the

success of the throughput concept, some or all of the following steps may be required:

- Establish throughput express MSR's on which throughput shipments have priority.

- Establish intensive management practices over shipments to assure—

Realtime or near-realtime identification of shipments at any location in the transportation pipeline.

Prompt diversion of cargo which may be required because of combat losses, unit displacement of addressee, etc.

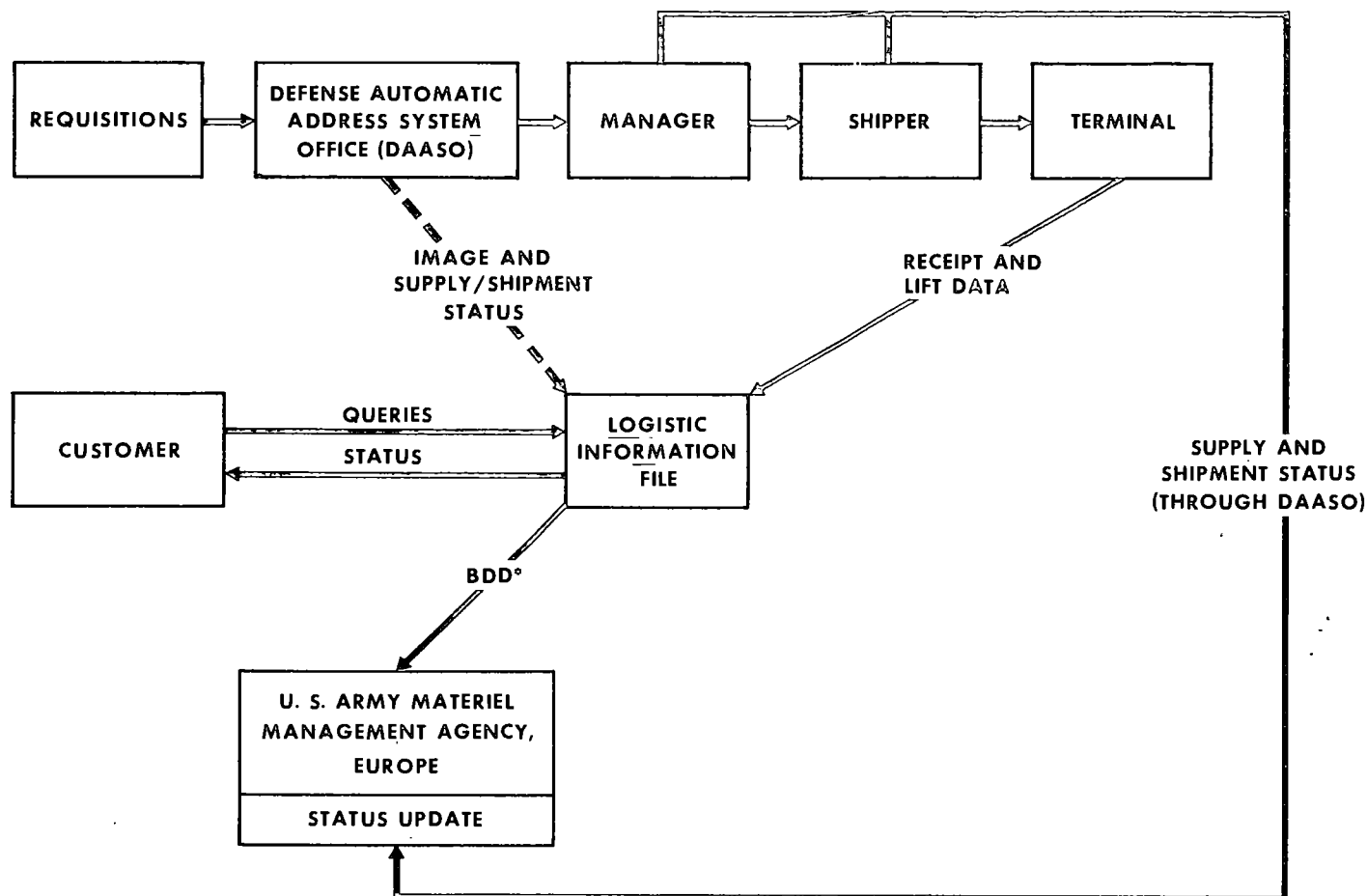
The Army's *in-transit asset visibility (IAV)* system, when fully developed, will permit continual visibility of container contents as the container moves along its route. The life substance of IAV is found in the *logistic information files (LIF)*, maintained by the *logistic control office (LCO)* and in the theater data bank.

Basically—

- All Army requisitions will pass through the defense automatic address system office (DAASO), where each requisition will be routed to the appropriate manager, with an image bled off into the LIF. As status information is passed back through DAASO, an image will again be bled to the LIF. This use of image copies of all *MILSTRIP* transactions will permit uninterrupted flow of requisitions and status information. *MILSTAMP* data will flow *directly* to the LIF.

Buildup of the LIF (as it applies to Europe, for example) is shown in figure 1-6.

¹ DSSA's and DISCOM's, particularly those DSSA's located in the COMMZ, may receive a small percentage of their supplies by direct container shipment from CONUS.



* The BDD is a shipment detail lift card — prepared by the logistic control office and routinely furnished to all overseas requisitioners at the time of lift from a CONUS terminal. The BDD is requisition-number oriented and can be used to establish an actionable due-in document.

Figure 1-6. Intertheater logistic information file buildup (in support of Europe).

Now — how does all of this add up to a capability for maintaining visibility and control of in-transit assets?

The LCO, operating around the clock 7 days a week can, in response to a customer inquiry, produce a complete data printout concerning the supply or transportation status of any overseas requisition or shipment. The system can give information on any one factor or combination thereof shown in figure 1-7.

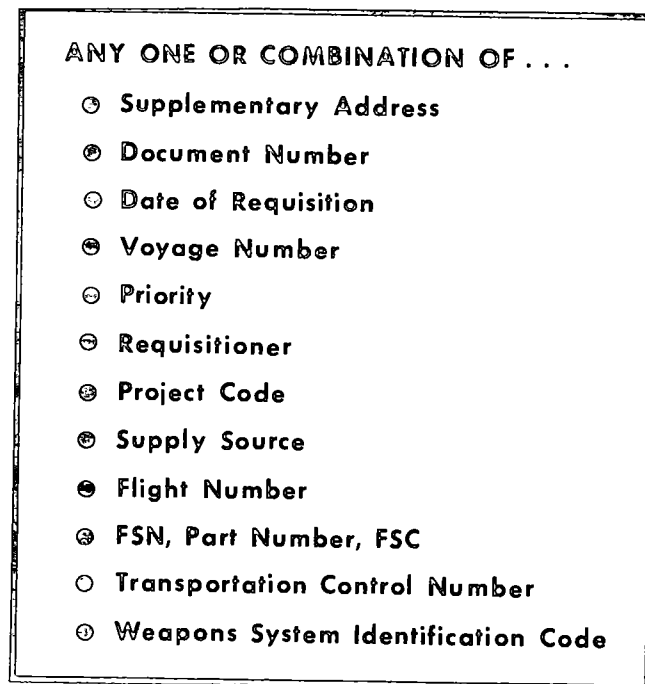


Figure 1-7. Logistic information file inquiry capability.

1-10. Containerizable Cargo

Various studies, together with experience gained in the past few years, indicate that approximately 80 percent of all DOD-sponsored resupply cargo is containerizable. With maximum use of flatracks for vehicles, this percentage can be substantially increased. Eligibility of a commodity for container shipment is based on—

Physical characteristics of the cargo.

Cost effectiveness and efficiency of the total distribution system.

Those items which offer the greatest potential for containerization are normally—

Subsistence

General supplies

Ammunition

PX items

Certain construction materials

Household goods

Personal property

On the other hand there are items which would not normally be considered eligible for container shipment. Some of these are—

Infrequently demanded items

Items prohibited by physical characteristics (size and shape)

1-11. Regulations and Policy

A transportation system in a theater of operations must be developed and operated in consonance with policies and directives of the Department of Defense and the Department of the Army.

AR 56-1 is of primary importance to transportation container operations in a theater of operations. Briefly, AR 56-1 identifies policy concerning—

- Use of military and commercial containers
- Guidelines and restrictions concerning container procurement and provides rationale for selection of cargo to be containerized. Department of Defense policy is to make maximum use of commercial assets in container operations and to limit military container acquisition to those items not available from commercial sources.

1-12. Military Operating Agencies Responsible for Transportation Support

There are three military operating agencies responsible for providing common-user transportation support for the Department of Defense within CONUS and between CONUS and overseas theaters:

- Military Airlift Command (MAC)—worldwide airlift capability
- Military Sealift Command (MSC)—worldwide sealift capability
- Military Traffic Management Command (MTMC)—
CONUS traffic management
CONUS land transportation
Common-user ocean terminals

The roles of these three operating agencies are summarized in table 1-1.

1-13. Responsibilities of the Army for Containerized Cargo

Responsibilities of the Army with respect to containerized movements include the following:

- In coordination with the other services, *determines characteristics of surface containers and container-related equipment that best meet the needs of the services.*

Table 1-1. Functional Description of the Department of Defense Cargo Transportation System

Functional link	Definition	Administered / managed by		Performed by		Paid for by	
		Airlift	Sealift	Airlift	Sealift	Airlift	Sealift
CONUS line haul	Movement between an inland military depot or supplier's plant in CONUS and a CONUS aerial port or seaport	MTMC	MTMC	Shipper services via contract air, commercial rail, highway, or inland waterway services	Shipper services via commercial rail, highway, or inland waterway services	Shipper services	Shipper services
CONUS port handling	Loading or unloading an aircraft or a ship at a CONUS aerial port or seaport (includes associated handling within the port area)	MAC	MTMC	MAC	MTMC, Navy, or contractual services	MAC (partial costs recovered from shipper services via industrial fund)	MTMC (partial costs recovered from shipper services via industrial fund)
Intercontinental transit	Carriage by aircraft or ship between CONUS and overseas ports	MAC	MSC	MAC with military aircraft and commercial augmentation	MSC with nucleus fleet and commercial augmentation	MAC (partial costs recovered from shipper services via industrial fund)	MSC (partial costs recovered from shipper services via industrial fund)
Overseas port handling	Loading or unloading an aircraft or a ship at an overseas aerial port or seaport (includes associated handling within the port area)	MAC Overseas command	J-4, OJCS Overseas command	MAC	US armed services and contractual services	MAC (partial costs recovered from shipper services via industrial fund)	Overseas command (partial costs recovered from shipper services)
Overseas line haul	Movement between an inland military depot overseas and an aerial port or seaport	Overseas command	Overseas command	Overseas command via military and commercial modes	Overseas command via military and commercial modes	Shipper services	Shipper services

MAC—Military Airlift Command (DOD single-manager agency for inbound and outbound CONUS air transportation).

MSC—Military Sealift Command (DOD single-manager agency for inbound and outbound US, coastwise, and intratheater sea transportation).

MTMC—Military Traffic Management Command (DOD single-manager agency for intra-CONUS military traffic management, land transportation, and common-user ocean terminals).

OJCS—Office, Joint Chiefs of Staff.

- Through the Army Materiel Command, *procures and maintains Army-owned containers, transport equipment, and materials handling equipment.*

- Through the Joint Container Control Office (JCCO), *exercises administrative control over all Army owned and leased containers, chassis, and bogie assemblies in worldwide service, and operational control over those assets located within or en route to CONUS.*

- Through MTMC, *arranges for movement of containerized Army cargo from CONUS to overseas destinations.*

- Other than for specific exceptions in contractual container service agreements, *moves containers within a theater of operations by all transportation modes.*

- Through the theater movement control activity, *manages, schedules, controls, and coordinates utilization of in-theater containers.*

- Through the theater movement control activity, *maintains an inventory of the location and status of containers in theater and, as required, provides this information to the JCCO on a near-realtime basis.*

- Through the theater movement control activity, *provides interface with the Military Traffic Management Command, the Military Airlift Command, and the Military Sealift Command to provide a free flow of operational data.*

- *In the theater, stows, documents, and unstows containers for intratheater and retrograde containerized movements.*

- *For military owned or leased containers, clears ports and air terminals.*

1-14. Responsibilities of the Navy for Containerized Cargo

Responsibilities of the Navy, which are carried out through the Military Sealift Command, include the following:

- *Provides for ocean transport of containers in support of all US armed forces.*

- *Plans for expansion of container sealift to meet the needs of contingency operations.*

- *Provides an immediate container sealift capability to the Department of Defense in emergencies.*

- *Oversees total global military sealift commitments.*

- *Plans and initiates fleet modernization actions to include the acquisition of container transport capability for use in areas where US flag container service is inadequate or where self-sustaining container ships are required but are not available.*

- *Establishes container agreements with commercial ocean carriers for container service between the port commercial zone or inland points in CONUS and overseas terminals and (at the option of the overseas commander) inland points in overseas areas.*

- *Receives requirements for container shipment and books the cargo.*

- *Reimburses the carrier from the Navy industrial fund for service covered by the container agreement and bills the services accordingly.*

1-15. Responsibilities of the Air Force for Containerized Cargo

Responsibilities of the Air Force with respect to containerized movements include the following:

- *In coordination with the other services, determines the characteristics of air containers that best meet the needs of the services and, at the same time, are compatible with the capabilities and limitations of cargo transport aircraft that are currently in or forecast to be in the military system.*

- *Provides for emergency or contingency augmentation of Air Force cargo lift capability by cargo transport aircraft of the civil reserve air fleet.*

- *Provides intertheater and, when required, limited intratheater airlift of containers.*

- *Loads, secures, and unloads container-carrying aircraft at aerial port and Air Force terminals.*



CHAPTER 2

TYPES OF CONTAINERS

Section I. THE COMMERCIAL CONTAINER

2-1. The Commercial Container and the Military System

At the present time, the military does not own a fleet of containers and container-related equipment large enough to support DCD container requirements.

It is not envisioned that in the foreseeable future the military will purchase sufficient containers to satisfy DOD requirements so long as commercial container service is available through contract or by leasing.

The purpose of this discussion is to present to personnel involved in container operations a description and photographs of the most common types of standard commercial containers which they must be prepared to handle.

2-2. Surface Container Standards

The *American National Standards Institute (ANSI)* has developed standards concerning—

- External dimensions (modular sizes)
- Maximum load limits
- Corner and stacking fittings

The *International Organization for Standardization (ISO)* has (except for the 24-foot and 35-foot containers) accepted the ANSI-developed standards.

ANSI standard modular sizes include three groups:

Group I demountable	{	10, 20, 30, and 40 feet long x 8 feet wide x 8 feet high
		24 feet long x 8 feet wide x 8 feet 6½ inches high
		35 feet long x 8 feet wide x 8 feet 6 inches high
Group II demountable	{	5 feet long x 8 feet wide x 8 feet high
		6½ feet long x 8 feet wide x 8 feet high
Group III	{	Series of stowable cargo containers of various sizes which can be efficiently stowed inside group I and group II demountable containers

Table 2-1 shows the dimensions and capacities of the more commonly used commercial containers.

Figure 2-1 illustrate the design and use of ANSI standard fittings and lifting and securing devices. (This material (fig 2-1) is reproduced with permission from American National Standard Specifications for International (ISO) Freighter Containers, ANSI MH5.4-1972, copyright 1972, by the American National Standards Institute, copies of which may be purchased from the American National Standards Institute at 1430 Broadway, New York, NY 10018.)

Table 2-1. Configuration of the More Common Commercial Surface Containers

Nominal exterior dimensions			Approximate interior dimensions ^a			Nominal exterior cube (ft ³)	Approximate interior cube (ft ³) ^a	Maximum gross weight (lbs)	Tare weight (lbs) ^b
<i>W</i>	<i>H</i>	<i>L</i>	<i>W</i>	<i>H</i>	<i>L</i>				
8' ^c	9'	40'	90"	101"	39'4"	2,880	2,625	67,200	6,300
8'	8'	40'	90"	85"	39'4"	2,560	2,090	67,200	5,000
8'	8'6"	35'	92"	93 7/8"	34'7"	2,408	2,088	45,000	4,000
8'	8'	30'	90"	85"	29'4"	1,916	1,703	56,000	4,300
8'	8'6½"	24'	93"	94¼"	23'6"	1,639	1,415	42,000—46,000	3,800
8'	8'	20'	90"	85"	19'4"	1,272	1,040	44,800	3,500
8' ^d	8'	10'	90"	85"	9'4"	628	490	22,400	2,000
8' ^d	8'	6'8"	90"	85"	6'1½"	413	329	15,680	1,880
8' ^d	8'	5'	90"	85"	4'6 3/8"	307	248	11,200	1,700

^a For allowable plus or minus tolerances of ANSI standard containers, refer to American National Standard MH5.4-1972 (para 2- 2).

^b Because of construction methods and materials used, tare weights may vary somewhat between manufacturers.

^c This container is not recognized as standard. However, a review of section V, MSC Container and Rate Guide RG-6, shows they are part of nearly every American flag carrier's container fleet.

^d Recognized as standard by ISO, but not by ANSI.

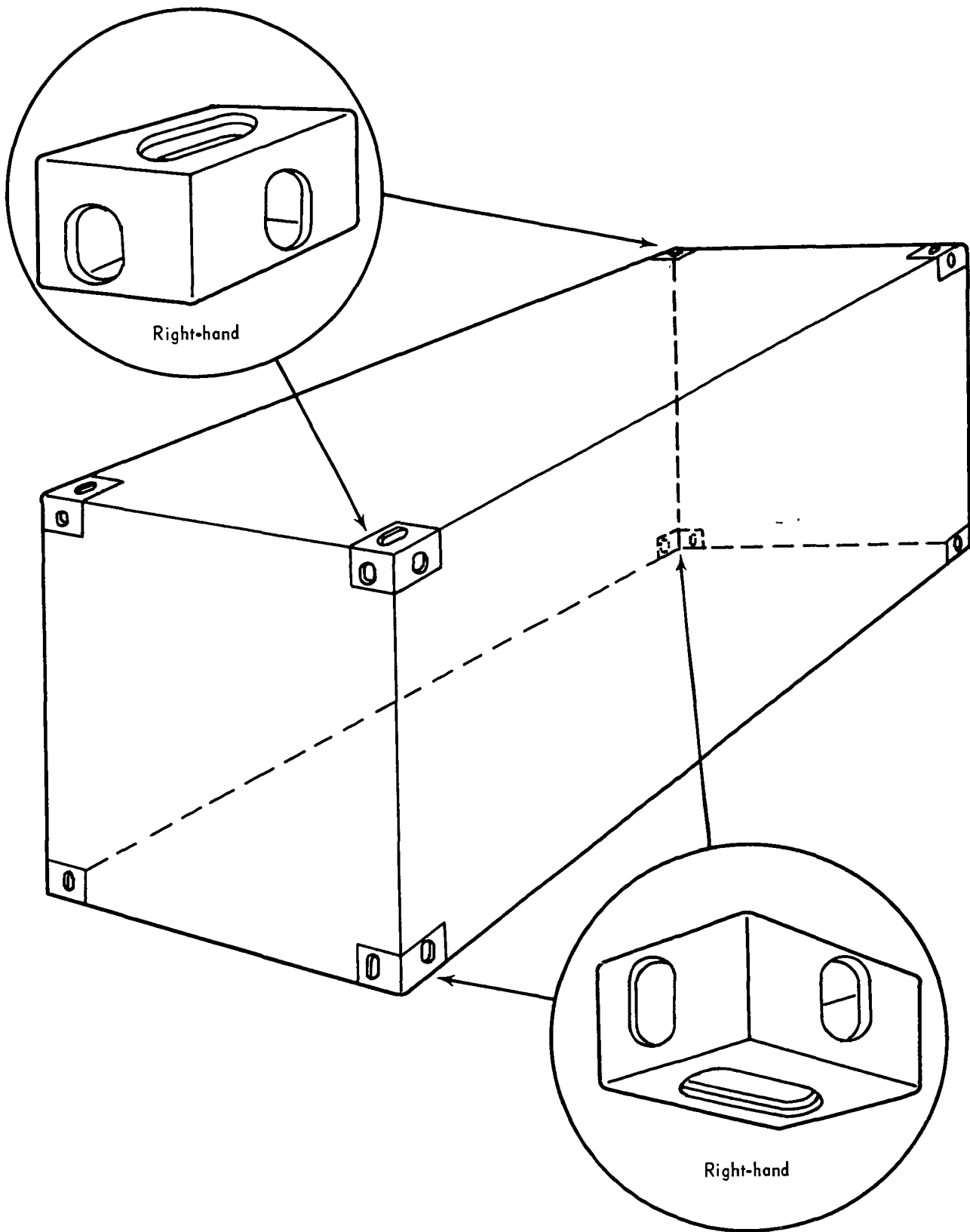
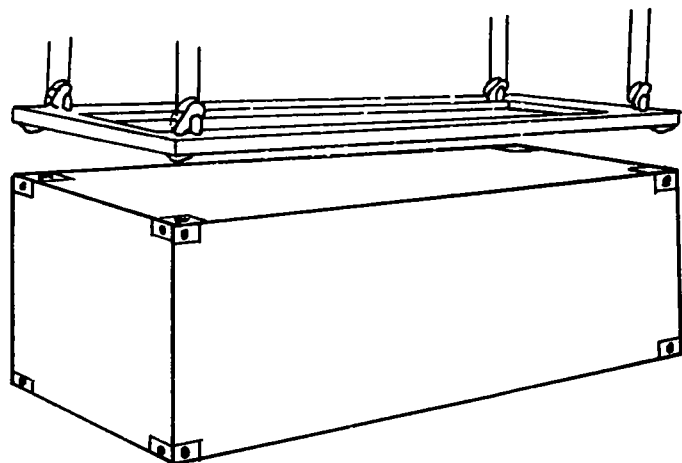


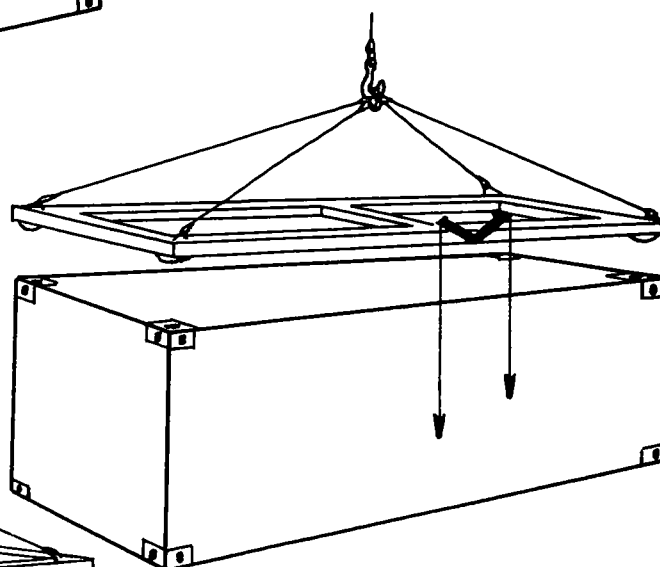
Fig. 1
Diagrammatic Sketch Showing Corner Fitting Locations

Figure 2-1. ANSI standard fittings. Standardization of fittings has made possible compatibility of containers and equipment both for commercial operators and the military.

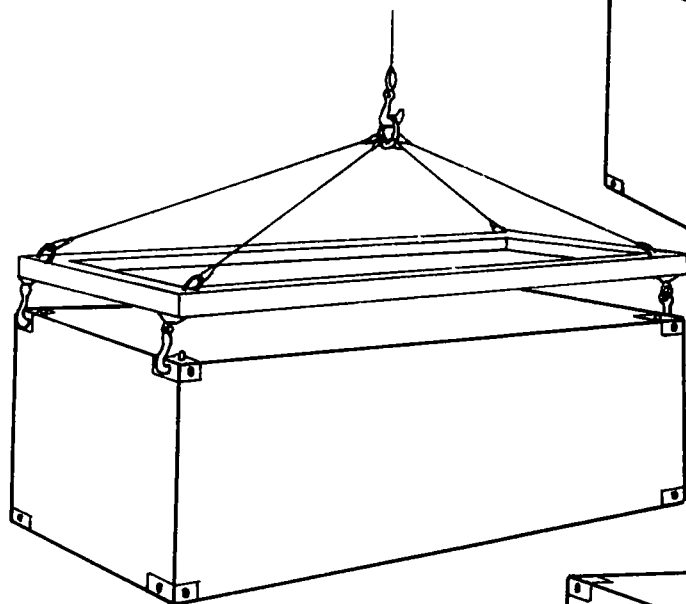
Annex A of Part IV
Typical Handling and Securing Devices



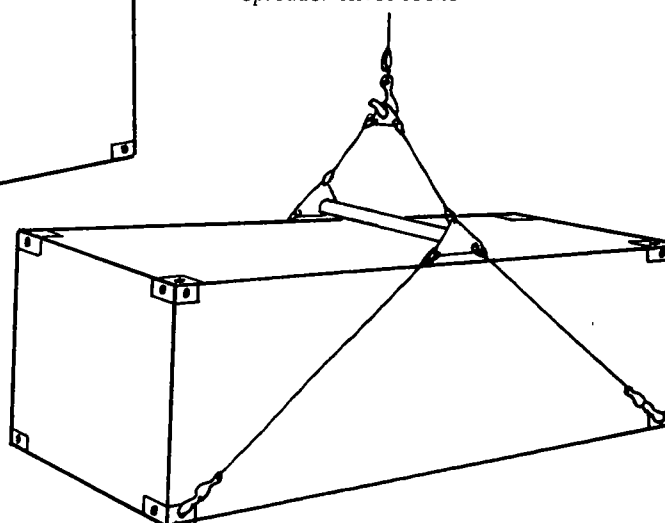
(a) Top lift automatic by means of spreader twist locks



(b) Top lift semi-automatic by means of spreader twist locks



(c) Top lift manual by means of hooks or clevis



(d) Bottom lift by means of slings

Fig. A.1
Examples of Methods of Lifting Containers by Corner Fittings

Standardization of corner fittings permits uniform procedures for lifting containers safely and efficiently.

Figure 2-1—Continued.

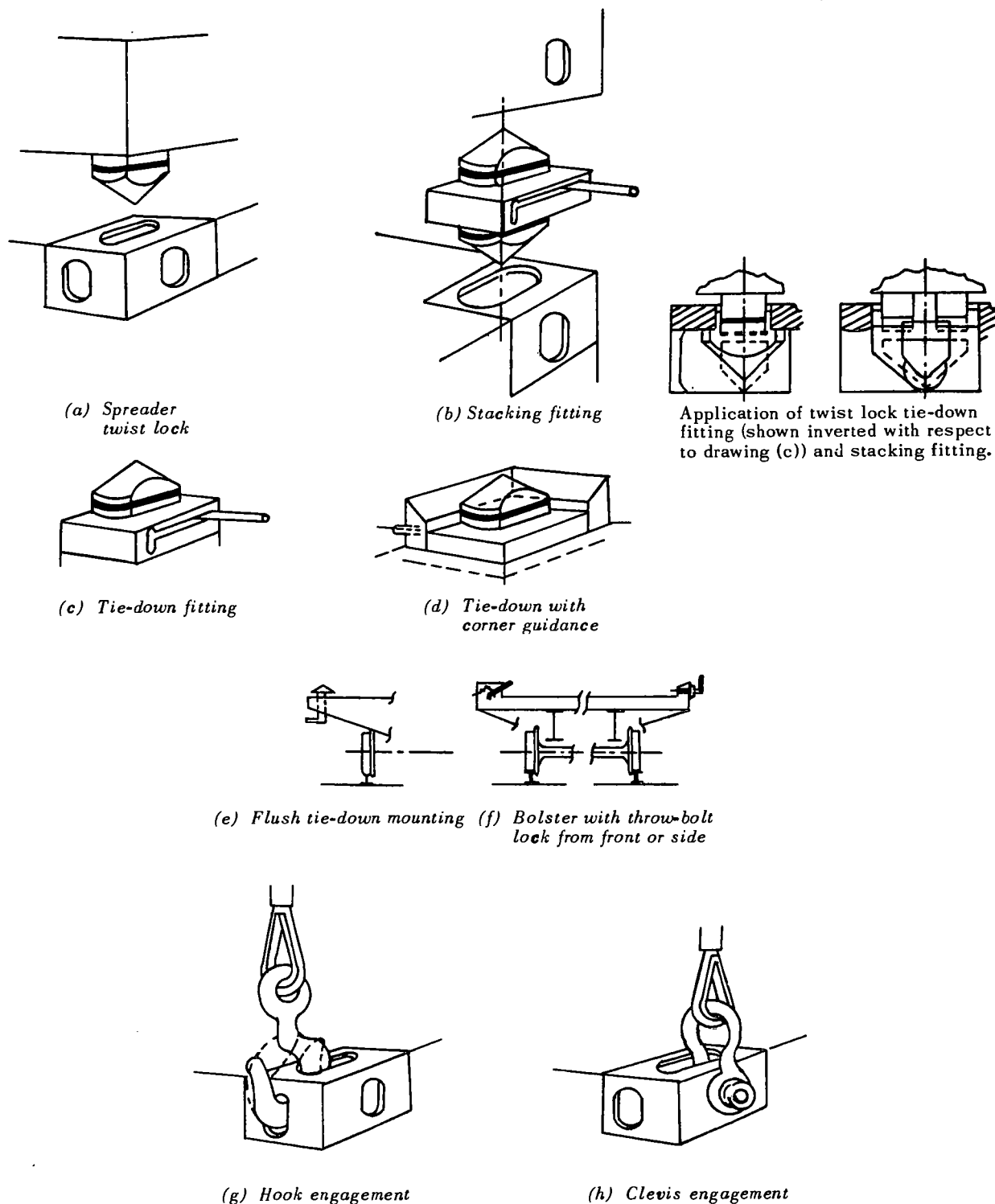
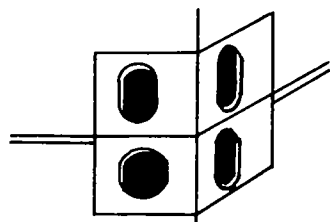


Fig. A.2

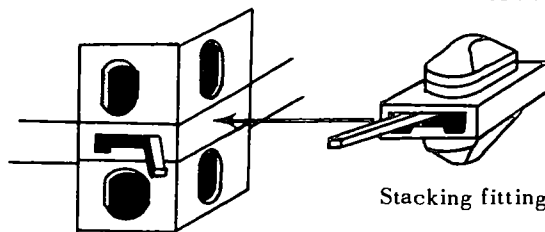
Examples of Corner Fitting Engaging, Lifting and Securing Devices

Interchange of containers between the various commercial operators and between commercial and military operators would not be possible without standardization of these devices.

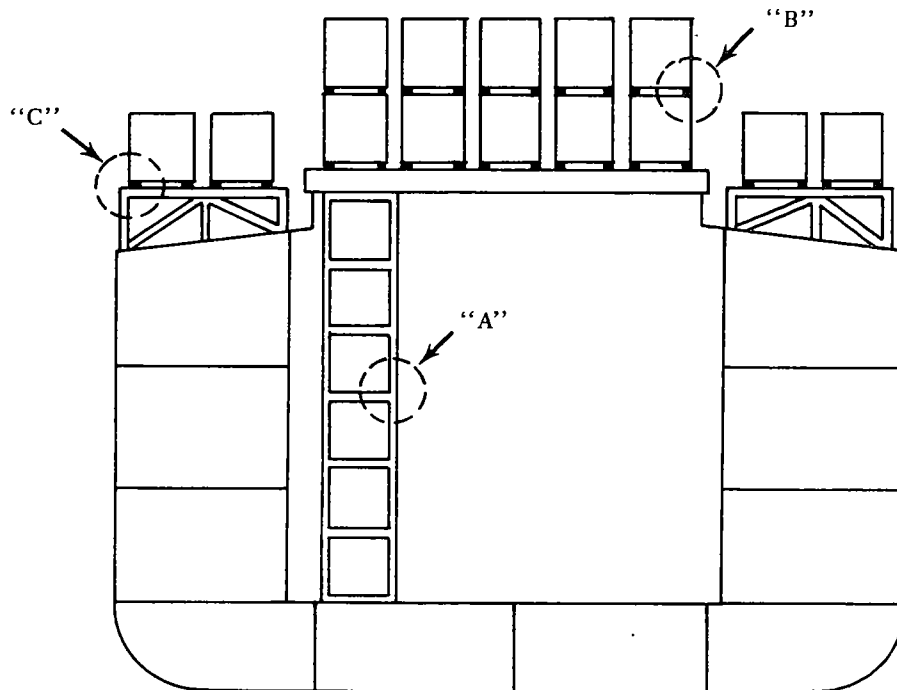
Figure 2-1—Continued.



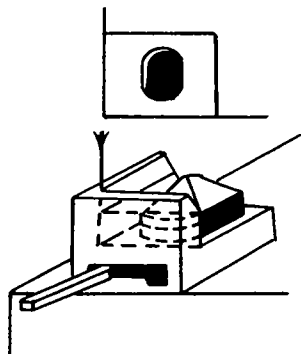
View "A"
Horizontal restraint
provided by ship's cell



View "B"
Stacking fitting provides
horizontal and vertical restraint



Example of container ship cross-section



View "C"
Example of deck securing fitting which provides
gathering plus both horizontal and vertical restraint

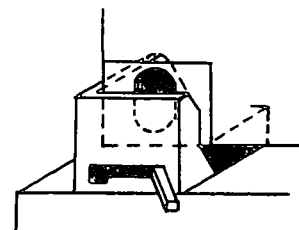


Fig. B.2
Examples of Use of Corner Fittings on Ships
(In Vertical Container Cells and on Deck)

Container fittings mate with ship fittings to provide horizontal and vertical restraint of deck-loaded containers.
Figure 2-1—Continued.

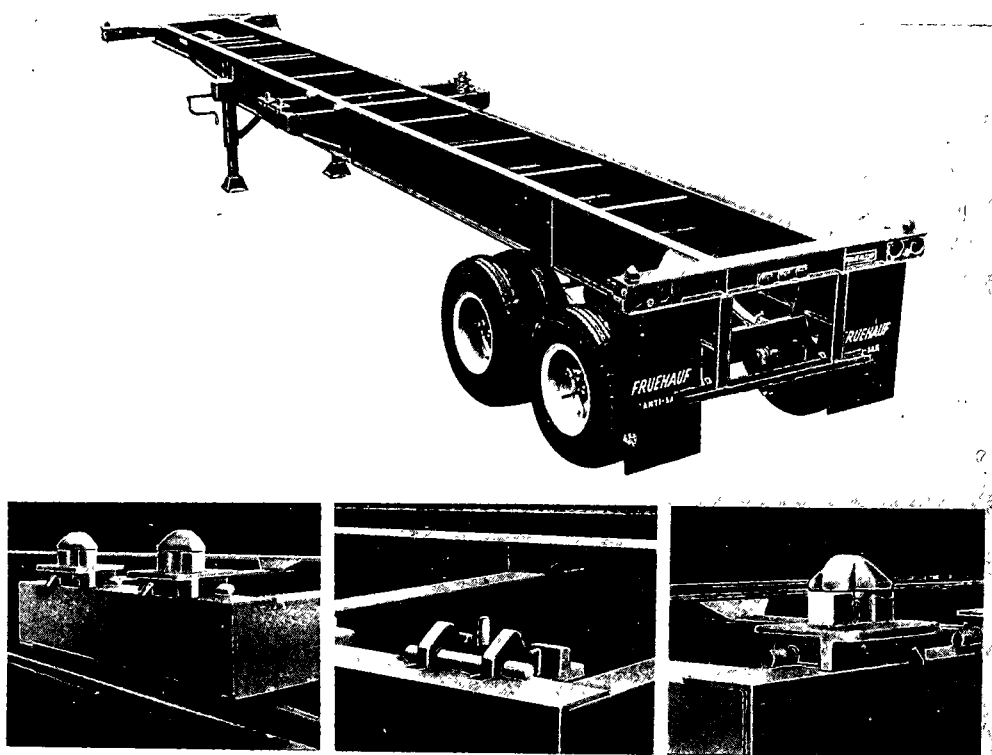


Figure 2-2. This 40-foot chassis is designed to handle one 40-foot or two 20-foot containers. The front and rear bolsters are fitted with ISO standard twist locks, and the center bolster (lower left) is equipped with two flip-up twist locks which can be stored in the down position (lower center) when transporting a 40-foot container and flipped to the up position (lower right) to secure and lock two 20-foot containers to the center bolster. The twist locks fit into ANSI/ISO standard corner fittings on the container, locking the container to the chassis. Here the platform has been removed from the chassis to show the locking devices more clearly. (Picture courtesy of Fruehauf Corporation.)

Not all container corner fittings and twist locking devices are standard throughout the industry. For example, Sea-Land is not the same as the rest of the fleet. Although Sea-Land has an adapter that permits it to handle all containers, not all carriers can handle Sea-Land equipment.

2-3. Dry Cargo Containers

Following is a brief description of dry cargo containers and illustrations of the most common types:

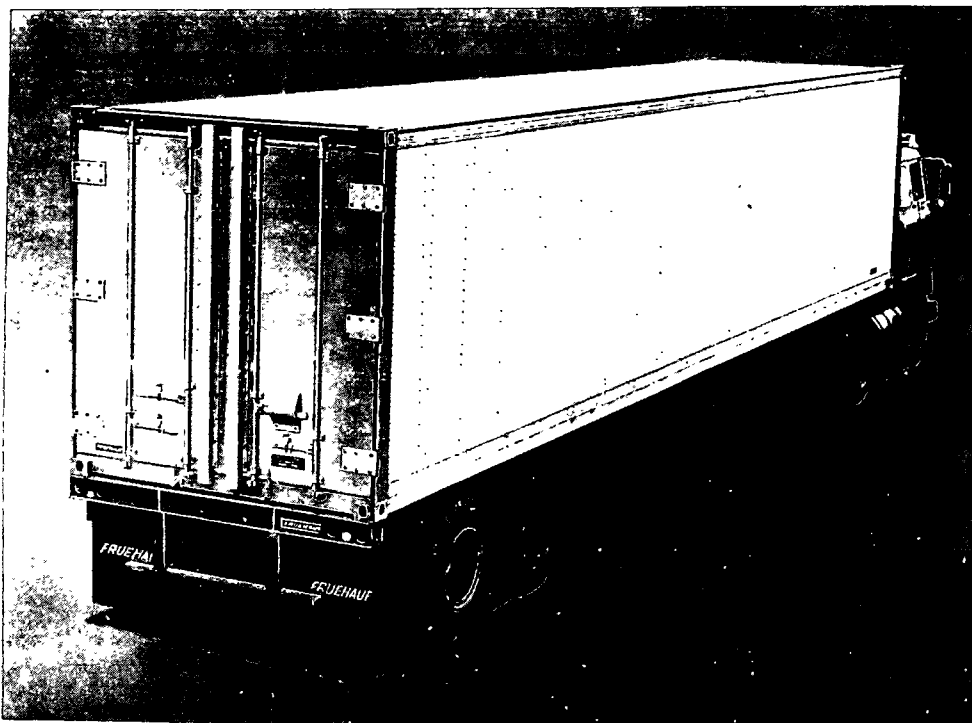


Figure 2-3. The closed-top dry cargo container is normally used for palletized or unitized cargo. Sizes run the range of ANSI standards and, depending upon the size and manufacturer, capacities may range from 9,500 to 62,200 pounds. The aluminum container pictured here is a 40-footer with a maximum gross weight of 67,200 pounds. (Picture courtesy of Fruehauf Corporation.)

- *Closed-top dry cargo container*—in the majority in today's container fleet:

Construction—steel, aluminum, plywood, plastic, fiberglass, or a combination of these; has hinged doors at the rear for stowing and unstowing cargo.

Cargo characteristics—cargo is normally palletized or unitized.

Cargo capacity—ranges from 9,500 to 62,200 pounds and from 248¹ to 2,090 cubic feet.

¹ In consonance with ANSI standards; however, by Army definition, equipment must have an interior volume of 400 cubic feet or more to be classified as a container (see glossary).

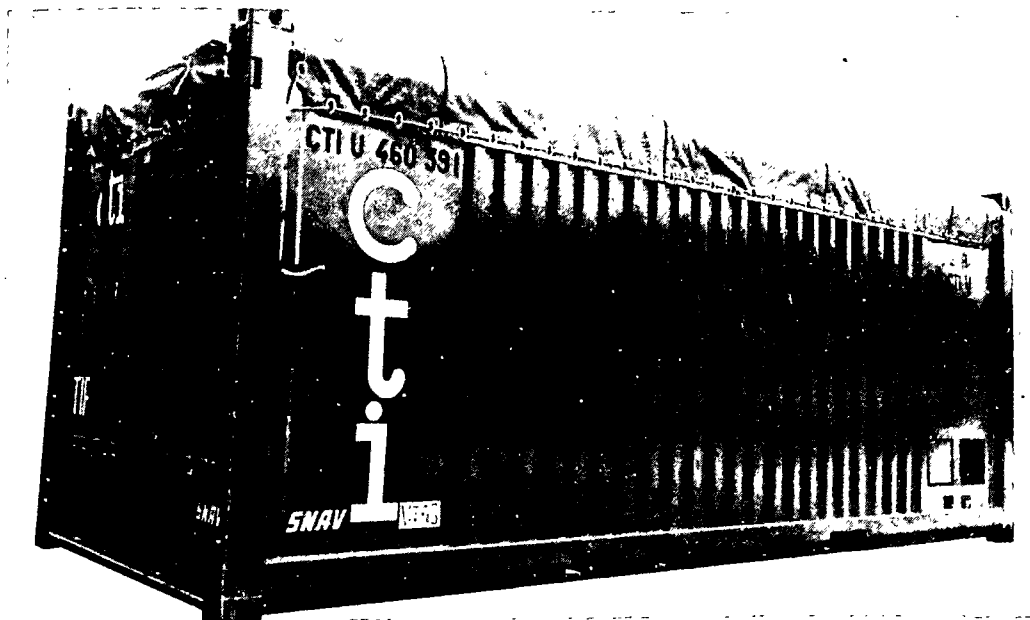


Figure 2-4. The open-top dry cargo container is similar in construction to the closed-top except that, as the name indicates, the open-top container has no roof. A tarpaulin is used when cover is required. The open top container is used primarily for heavy bulky cargo which can be better loaded through the top than through a door. (Picture courtesy of Container Transport International, Incorporated.)

- Open, top (bulk) dry cargo container—covered by tarpaulin when loaded:

Construction—same material as closed-top; has standard hinged doors at the rear that permit stowing and unstowing cargo in the same fashion as the closed-top container; may also be stowed and unstowed through the top.

Cargo characteristics—cargo normally of

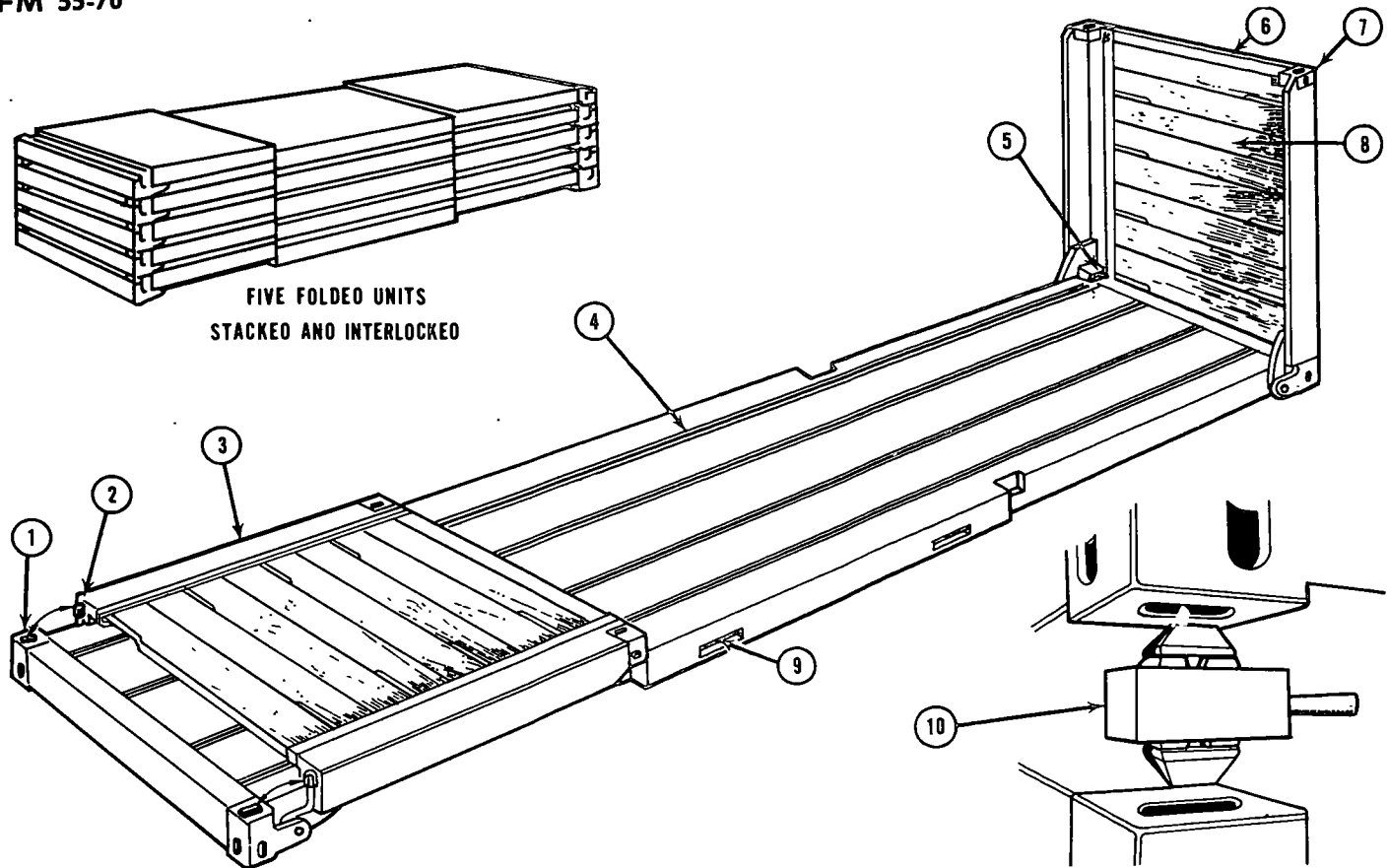
physical characteristics which can be more efficiently stowed through the top than through a door opening. For example—

Heavy machinery

Bulk grain, cement, fertilizer

Long lengths of pipe or lumber

Cargo capacity—same as closed-top.



1. Corner fitting incorporating ISO compatible apertures, including top aperture for accepting post lock fitting in service mode and stacking interlock fitting in folded mode.

2. ISO standard shaped lock fitting lock corner post in service mode.

3. End wall shown folded and locked for empty return shipping.

4. Tiedown tracks to accept "T" base tiedown device.

5. Post lock actuator.

6. Removable header.

7. ISO top corner casting.

8. Bullboards.

9. Fork tineways.

10. Stacking interlock for securing folded units for empty return allows 5-to-1 volumetric reduction.

Figure 2-5. Artist's sketch showing a folding flatrack container. This container is particularly suited for carrying equipment and vehicles that will not fit into an 8-foot-wide container but will fit into selected container cells. Since it is collapsible, it reduces space requirements for empty shipment. The end walls are secured either by folding braces or cable braces. The flatrack is available in lengths of 20, 24, 35, and 40 feet.

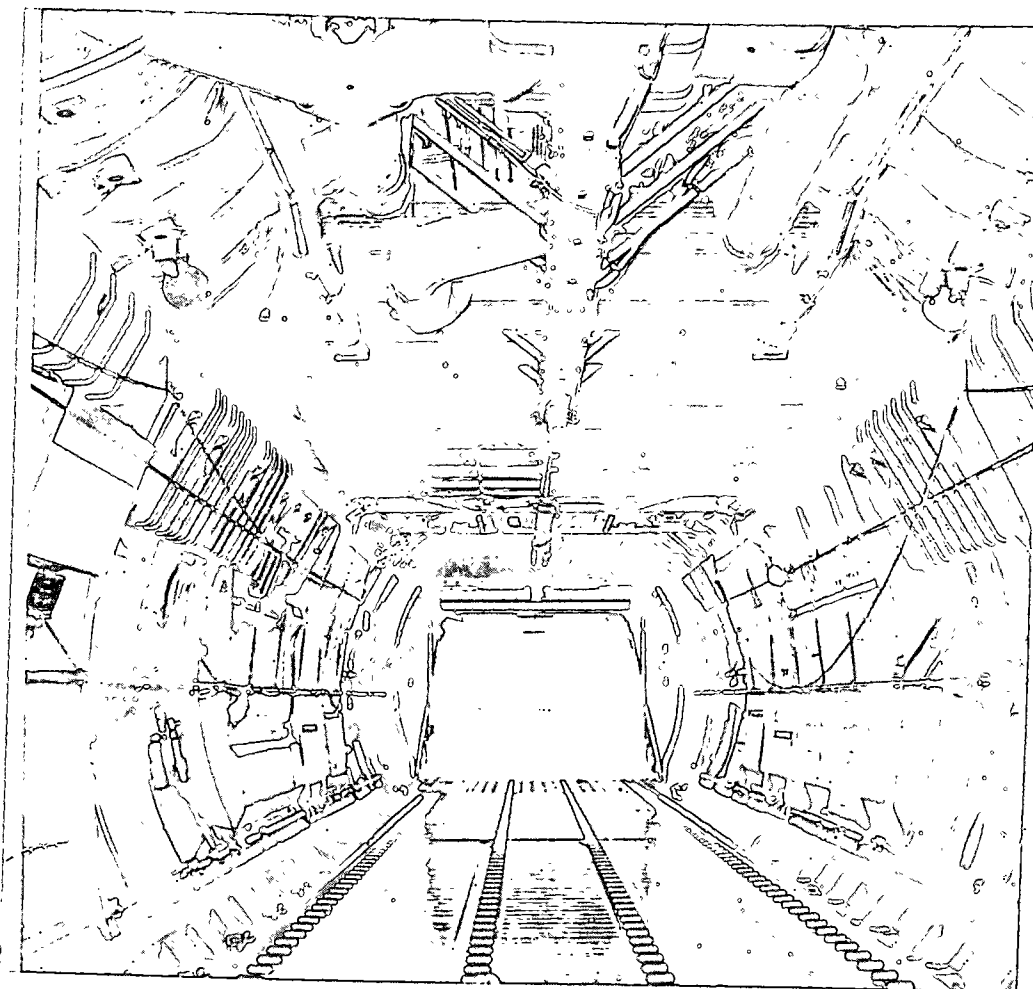


Figure 2-10. Movement of containers in an Air Force aircraft is normally restricted to the 20-footer and requires that the container be restrained to a platform that is compatible with the Air Force 463L conveyer system found in C-130, C-141, and C-5A aircraft. This photograph shows the 463L conveyor system installed in the cargo deck (looking aft) of the C-141 aircraft. (Picture courtesy of US Air Force.)

The allowable gross weight for transport of the 20-footer in Air Force aircraft varies between aircraft as shown below. Where it is not known on which aircraft the container will be moved, the maximum gross weight for the C-141 should be used.

	Maximum gross weight (pounds) ^a	Payload (pounds)
C-130	29,000	24,000
C-141	26,500	21,900
C-5A	43,500 ^b	38,900

^a Maximum gross weight is governed by aircraft floor loading factors.

^b Special provisions can be made to carry a fully loaded 20-foot container on the C-5A aircraft at a maximum gross weight of 44,800 pounds

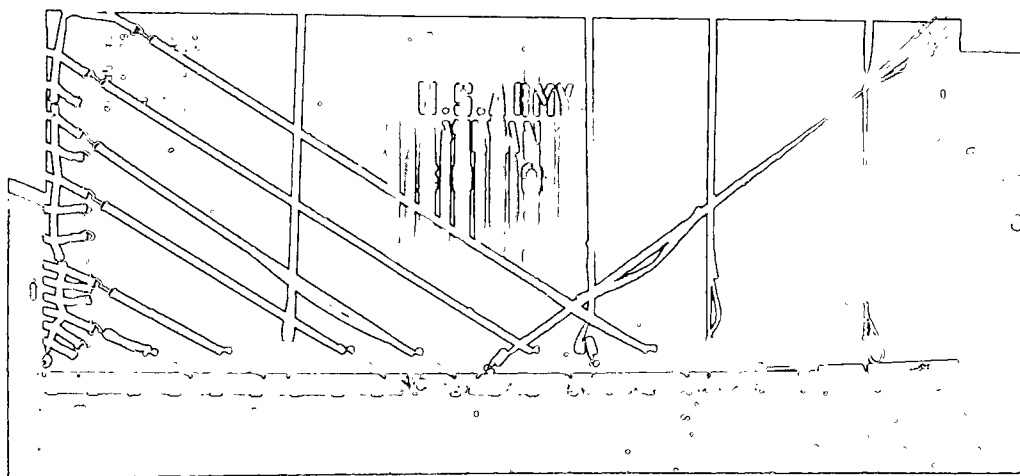


Figure 2-11. An Army-owned 20-foot MILVAN container loaded on a 20-foot metric platform for transport on a US Air Force aircraft equipped with the 463L handling system. Commercial 20-foot containers may also be transported by this method. (Picture courtesy of US Air Force.)

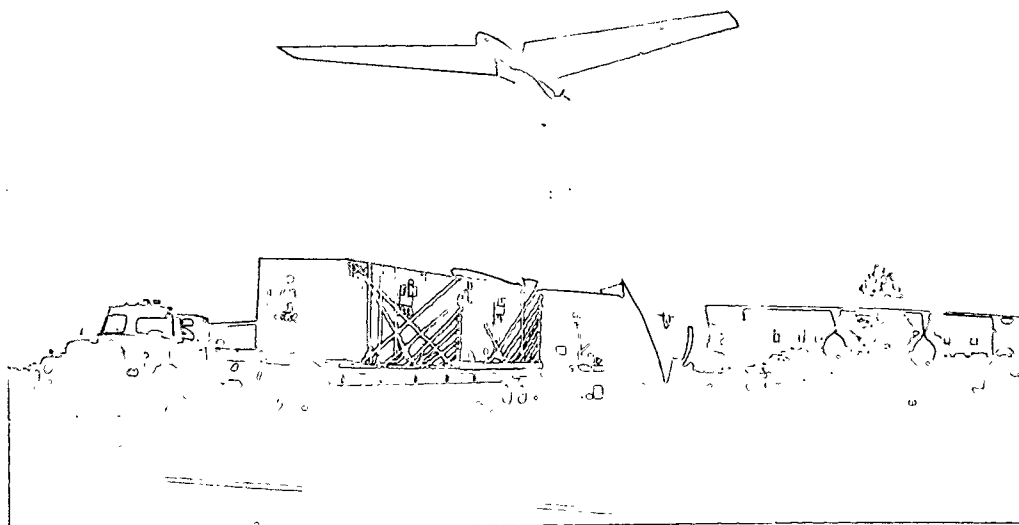


Figure 2-12. The 20-foot MILVAN container (and the commercial 20-footer) can be transported by the C-130, C-141, and C-5A aircraft. Shown here are two US Army MILVAN's and an Air Force container being loaded into a C-141 aircraft. (Picture courtesy of US Air Force.)

Movement of the MILVAN container in Air Force aircraft requires—

- Restraint of the container to a platform compatible with the 463L handling system:
 - Metric platform (A/E-29H), 20-foot
 - Type II 20-foot airdrop platform

◦ Webbing straps for securing the van to the platform.

Because of the MILVAN design, the 463L pallet is, after one use, damaged beyond any further use. For this reason, the 463L pallet should not be used as an adapter platform. This

problem does not exist with the metric or airdrop platforms.

Air transport of the MILVAN container should not be routine, but rather on an emergency or high priority basis. This is because of the high tare weight of the container, which reduces payload accordingly.

A single TRICON modular container can be transported on a 463L pallet secured by a net. When TRICON containers are combined into a three-unit module, they are transported in the same manner as the MILVAN.

Section III. THE FAMILY OF MILITARY CARGO CONTAINERS

2-7. Requirement for Military Containers

Most of the container service support for the military is provided by commercial operators, and this is expected to continue to be the case.

However, there is a requirement for Army-owned containers when commercial containers are not available in the quantity and type required. *Overall efficiency and cost effectiveness* of military cargo container operations demands selection and standardization of a minimum number of container types not available commercially but required to satisfy military logistic support requirements. The containers discussed in this section constitute the family of cargo containers available commercially or being considered for development by the Army; these containers meet ANSI/ISO standards for corner fittings, load factors, and handling and coupling devices.

2-8. Container, Dry Cargo, Modular, TRICON

The *TRICON* container is currently an experimental item, designed to replace the container express (CONEX), a nonstandard military container that is being phased out of the system by attrition at the rate of approximately 5 percent per year.

The TRICON container is a *modular type* (8x8x6 2/3 feet) which, in groups of three, *forms an 8x8x20-foot container* that is compatible with the commercial container system.

- *Construction* may be of steel, aluminum, or fiberglass; container doors are located to provide accessibility to the interior of each container of a coupled unit without removal from the transport mode.

- *An individual unit—*

Has a maximum gross weight of 15,000 pounds.

Has corner lifting lugs that permit top lifting.

Has four-way forklift truck tine pockets that permit bottom lifting and stacking by forklift.

Has a surfaced bottom that permits it to be skidded.

When fitted with tiedown fixtures or adapters, is compatible with the 463L pallet.

Is used to carry general military supplies on pallets or unitized.

Has a cargo capacity up to 13,000 pounds.

- A unit of *three TRICONS—*

Has a maximum gross weight of 45,000 pounds.

Is compatible with transport and handling equipment normally used with 20-foot MILVAN containers.

- The *concept of employment* is as follows:

Used as an intertheater container to move high priority shipments by air to consignees within the oversea area.

Used within a theater of operations as a primary means of shipping general military supplies from general support supply activities (GSSA's), direct support supply activities (DSSA's), and the division support command (DISCOM) to supply facilities and to ultimate users in the forward area of the combat zone.

When deployed by surface mode to a theater of operations, normally moved in the 20-foot configuration in the cell of a container ship.

Normally employed in the forward area as individual TRICON containers. TRICON's loaded with cargo are transported by highway, rail, barge, or rotary- and fixed-wing aircraft from the support facility to distributors and users in the brigade and battalion areas and returned empty or loaded with retrograde cargo to the point of origin.

When moved by highway, the container is transported, demounted, mounted, and returned by either the 20-foot special purpose self-load/unload tactical semitrailer or by the 20-foot dual purpose tactical semitrailer in combination with appropriate materials handling equipment.

2-9. Container, Dry Cargo, 20-Foot MILVAN

The Army depends primarily upon commercial resources for 20-foot cargo container (table 2-1) support. However, the Army has purchased a limited number of 20-foot containers known as the MILVAN (military van) that will be used until they are no longer economically repairable. As shown in figure 1-4, both the commercial and military versions are used in intertheater and intratheater movement.



Figure 2-13. Sling loading a 20-foot MILVAN container onto a container transporter for highway movement. A spreader bar is used to prevent the sling cables from converging toward the apex of the lifting slings at an angle that will cause compression loads that will damage the container. Although the 20-footer is planned primarily for intratheater line haul of general military supplies from the GSSA to the DSSA and the DISCOM, it can also be used in intertheater movement. (US Army photograph.)

The Army-owned MILVAN, first introduced into the system in 1969, is used primarily for intratheater transport of dry cargo from GSSA's to DSSA's and the DISCOM. Characteristics are shown in table 2-2.

- **Construction**—fabricated of steel; lined with plywood or, if to be used to transport ammunition, interior has a mechanical load bracing

system (para 2-10); has hinged doors at the rear for stowing or unstowing container contents. Because it has no bottom forklift pockets it cannot be handled by forklift; normally, lift is by top corner fittings, and handling is best accomplished by top loaders. If sling lifted, a spreader bar is used to prevent damage to the container.³

Table 2-2. Characteristics of the Army-owned 20-foot MILVAN container. With installation of an internal mechanical load bracing system, the MILVAN is suitable for carrying ammunition (para 2-10).

	With plywood interior paneling	With internal mechanical load bracing system
Exterior dimensions:		
Width	96 inches	96 inches
Height	96 inches	96 inches
Length	238.5 inches	238.5 inches
Interior dimensions:		
Width	92 inches	91.75 inches
Height	87 inches	87 inches
Length	231 inches	231 inches
Door opening:		
Width	90 inches	89 inches
Height	84 inches	84 inches
Exterior cube	1,270 cubic feet	1,270 cubic feet
Interior cube	1,070 cubic feet	1,060 cubic feet
Maximum gross weight	44,800 pounds	44,800 pounds
Tare weight	4,700 pounds	5,640 pounds
Payload	40,100 pounds	39,160 pounds

³ The Army-owned 20-foot MILVAN may be lifted by a sling and bridle arrangement with hooks or clevises which engage the four bottom corner fittings, provided:

1. The legs of the slings are of sufficient length that the angle of lift is not less than 60° from the horizontal axis.
2. The bridle arrangement does not allow the legs of the sling to bear on the top rails of the container.
3. The bridle is manufactured from wire rope or cable with load values exceeding load conditions.

- *Cargo characteristics*—cargo consists of general military supplies, normally palletized or unitized.

- *Cargo capacity*—up to 40,100 pounds and/or 1,070 cubic feet.

- *Concept of employment*—initially deployed overseas by container ship; subsequently employed for intratheater line haul by motor transport of general military supplies from GSSA's to DSSA's and DISCOM's. In addition to line haul motor transport, the 20-foot MILVAN may be transported by rail, barge, and

rotary-wing aircraft and, in contingencies or emergencies, by fixed-wing aircraft.

2-10. Container, Ammunition, 20-Foot MILVAN

With installation of an internal mechanical load bracing system, the 20-foot MILVAN is currently the primary ammunition container in the Army container distribution system. Plans call for development of a similar type of conversion kit to be used with the commercial 20-footer. Characteristics of the converted MILVAN are shown in table 2-2.

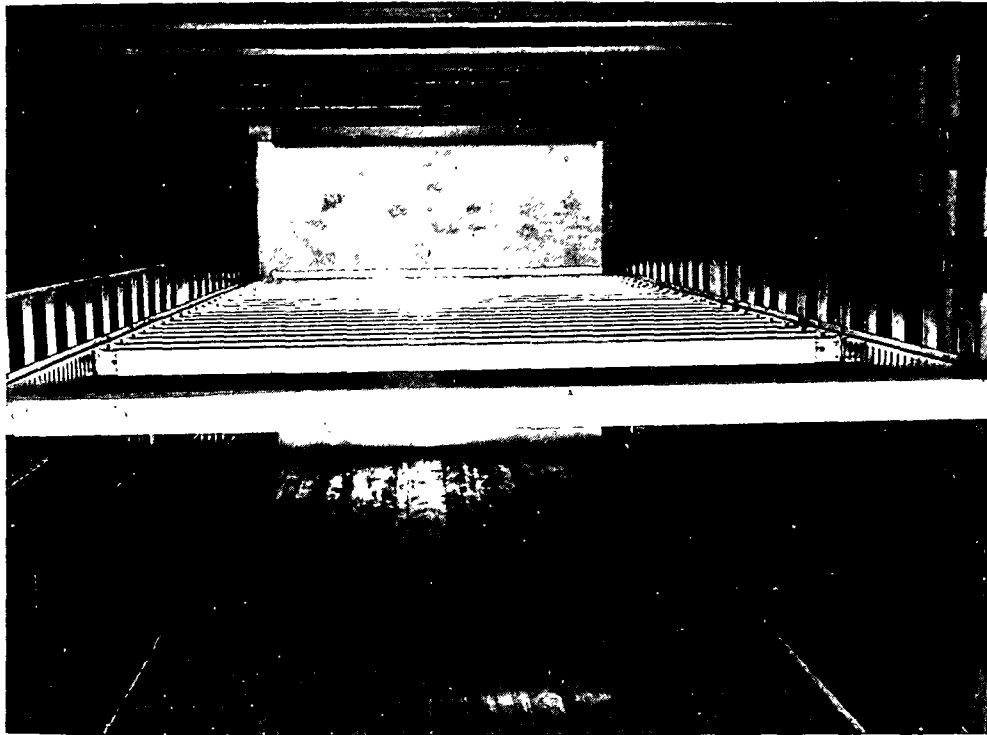


Figure 2-14. This picture of the ammunition-carrying MILVAN shows the internal mechanical load bracing system. Thus equipped, the container is used for intertheater transport and intratheater line haul of all types of ammunition.

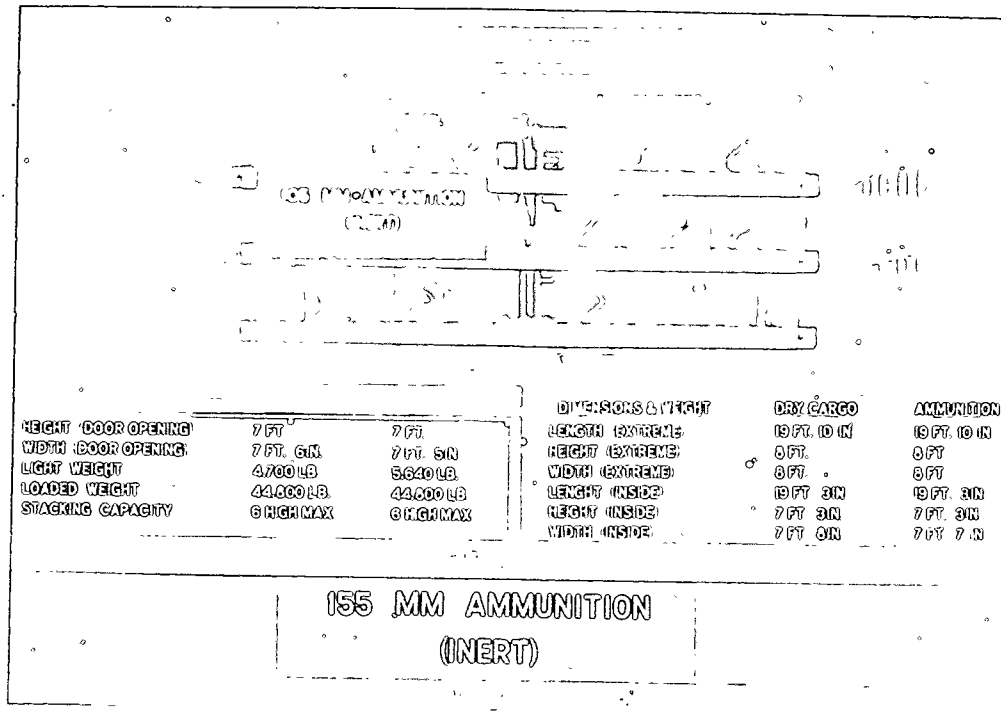


Figure 2-15. Palletized ammunition loaded in a 20-foot MILVAN container and secured by the internal mechanical load bracing system. When the container is moving empty, the bracing must be with it to assure its availability when ammunition is to be stowed.

◦ **Construction**—in the ammunition-carrying MILVAN, interior plywood paneling is replaced by an internal mechanical load bracing system.

◦ **Cargo characteristics**—can carry all types of ammunition.

◦ **Cargo capacity**—up to 39,160 pounds, or 1,060 cubic feet.

◦ **Concept of employment**—used for intertheater transport of ammunition by container ship and for intratheater line haul motor transport of ammunition. In addition to line haul motor transport, it may be moved within the theater by rail or barge or, within weight limitations and safety restrictions, by air. It should be noted that no commercial container has as yet received US Coast Guard certification for use in the shipment of ammunition.

2-11. Container, Dry Cargo, 40-Foot

The commercial 40-footer is the primary container in the Army container distribution system for the transport of dry cargo from CONUS to the GSSA's in the theater of operations. It is not anticipated that the Army will procure the 40-footer. Container characteristics are shown in table 2-1.

◦ **Construction**—design is commercial, and conforms to ANSI/ISO standards of weight, size, and structural integrity.

◦ **Cargo characteristic**—used primarily for

palletized or unitized general supplies and equipment.

◦ **Cargo capacity**—maximum gross weight of 67,200 pounds; minimum usable inside volume and maximum tare weight are shown in table 2-1.

◦ **Concept of employment**—normally employed for routine supply. Additionally, it is a preferred means for transporting *retrograde* materiel and for *preloading and shipping* general military supplies in *emergency and contingency operations*.

Typical employment is—

From CONUS depot or installation to CONUS port by commercial chassis

From CONUS port to overseas port by container ship

From overseas port to GSSA's in the communications zone and corps areas by line haul truck tractor and semitrailer container transporter.

The 40-foot container can also be moved by rail or barge, externally (within weight limitations) by rotary-wing aircraft and, under emergency conditions, by fixed-wing aircraft.

2-12. Container, Flatrack, 40-Foot

The 40-foot flatrack is used primarily in unit deployment and for transporting outsize cargo within the logistics support system. A recent study⁴ concludes that the employment of

⁴ US Army Transportation Engineering Agency Report 71-39, "Utilization of Flat Racks in Force Deployments," November 1971.

flatracks to move such cargo more than double the tonnage of containerizable equipment within the division.



Figure 2-16. An armored personnel carrier M113A1 mounted on a flatrack container. Note that there is a vehicle overhang, but this can be accommodated when the flatrack is placed in a container cell. The 96-inch width of the flatrack fits into the container guide in each corner of the container cell, and the space between the forward edge of the container guides and the container cell walls takes care of the overhang. (US Army photograph.)

- **Construction**—construction of the 40-foot flatrack is essentially the same as that of the 8x8x40-foot commercial flatrack (para 2-3); handles loads exceeding 96 inches in width, being limited only by the width of the container cell; has end posts or end vertical supports that—

Permit stacking within container ship cells.

Adjust from a minimum outside height of 72 inches to a maximum outside height of 114 inches.

Fold inward to minimize cube for shipment and storage of empty flatracks.

Fold outward to permit moving of vehicles onto the rack.

- **Cargo characteristics**—transports such outsize cargo as the 5-ton tractor and the armored personnel carrier M113A1,⁵ structural materials, unit equipment (particularly during unit deployment), container shelters, and TRICON modular containers.

⁵ TB 55-46-1 shows that the width of these vehicles exceeds 96 inches; however, the width of the container cell accommodates the overhang resulting from loading the vehicle on a 96-inch-wide flatrack.

◦ *Cargo capacity*—maximum gross weight, 67,200 pounds; payload, 60,000 pounds.

◦ *Concept of employment:*

From CONUS depot by container ship to the oversea theater terminal in resupply operations. Although some flatracks with certain types of cargo will be moved beyond the terminal to depots as far forward as the corps area, most will be unloaded at the terminal and their cargo moved forward by other means.

In unit deployment for transport of unit equipment and supplies by container ship to an oversea water terminal and, if appropriate, on to the unit oversea marshaling area.

For retrograde of materiel and withdrawal of units from an oversea area.

Normally transported overland by either the commercial chassis or the military 34-ton break-bulk/container transporter (para 3-10); can also be moved by rail and inland waterway and, under emergency conditions and within load limits, by cargo aircraft and the heavy lift helicopter.

2-13. Container, Refrigerated, 20-Foot

The 20-foot refrigerated container is used primarily for line haul transport, temporary storage, and distribution of temperature-sensitive cargo *within the theater of operations* and for augmentation of commercial resources in ocean shipment of temperature-sensitive cargo from CONUS to the theater of operations. It is intended that the container will replace the 7½-ton M349 van for the movement of these supplies.

◦ *Construction*—design and construction are essentially the same as for the commercial

refrigerated container (para 2-4); has a self-contained generator that is compatible with standard shipboard and military generator electrical power supplies; has both refrigerating and heating capability.

◦ *Cargo characteristics*—cargo consists of items that require stabilization of internal temperature by refrigerating or heating; includes such cargo as frozen foods, fresh produce, dry batteries, film, electronic equipment, and medical supplies.

◦ *Cargo capacity*—comparable to that of the commercial 20-foot refrigerated container (para 2-4).

◦ *Concept of employment:*

Used primarily to transport and temporarily store temperature-sensitive cargo within the theater as far forward as DISCOM and brigade supply facilities.

Supplements commercial operations, when required, for throughput shipment of temperature-sensitive cargo from CONUS to the theater of operations and on to forward supply facilities.

In emergencies, used to hold and transfer human remains.

Typical employment—after initial deployment by container ship to the oversea theater, will normally remain in the theater to be used for line haul motor transport, temporary storage, and local distribution purposes.

May be transported by highway transport equipment, rail, rotary-wing aircraft, and, under contingency or emergency conditions, by fixed-wing aircraft.

Section IV. SUMMARY

The military, for the foreseeable future, will depend upon commercial container service for most of its containerized logistic support. However, there is a requirement for Army-owned containers when commercial containers are not available in the quantity and type required.

Efficiency and cost effectiveness of military container operations requires the selection and standardization of a minimum number of container types that will satisfy military logistic support requirements. Further, because of the military's dependence upon commercial container facilities, Army-owned containers must be compatible with commercial container transport and handling equipment.

The following types of containers—either

available from commercial resources or being considered for development by the Army—constitute the basic family of military containers:

- Container, dry cargo, modular (TRICON)
- Container, dry cargo, 20-foot MILVAN
- Container, ammunition, modified 20-foot MILVAN

- Container, dry cargo, 40-foot
- Container, flatrack, 40-foot
- Container, refrigerated, 20-foot

All the above containers—

◦ Meet ANSI/ISO standards for corner fittings, load factors, and handling and coupling devices.

◦ Are compatible with military and commercial container transport and handling equipment.

CHAPTER 3

CONTAINER HANDLING EQUIPMENT

Section I. INTRODUCTION

3-1. Requirements for Container Handling Equipment

During peacetime operations, the military relies primarily upon commercial facilities for port handling and onward movement of containerized cargo. Conditions other than peacetime may present a different picture: ✓

- Existing commercial port handling facilities may be destroyed, rendered inoperable, or their use denied by enemy action.

- The operational environment or the nonexistence of port facilities may require movement of containers over the beach. Commercial operators are not currently equipped or prepared for a logistics over-the-shore (LOTS) operation.

- Combat or contingency operations in division support command, brigade, and battalion areas may require a degree of tactical mobility that cannot be provided by commercial operators.

- In a hostile environment, intratheater commercial container operations may be so severely restricted that they cannot provide the container support envisioned for the Army in the field.

For the above reasons, the Army must assure that a US/NATO military controlled capability is available to meet operational requirements, and that this control capability will, of necessity, include commercial containers. Major items of required equipment and the units to which they will be assigned are shown in table 3-1.¹

3-2. Military Adoption of Commercial Equipment

Many military requirements for container handling equipment can be satisfied by the adoption of commercially available items; this is accomplished—

Table 3-1. Major Items of Container Handling Equipment Required for Army Container Operations^a

Equipment	Terminal service company (container)	Terminal transfer company	Medium truck company	Light-medium truck company	Motor transport company
<i>Materials handling equipment:</i>					
Truck, forklift, frontloader, 50,000-pound capacity with top-lift attachments at a 48-inch load center, rough terrain	x ^b	x			
Truck, forklift, 15,000-pound capacity at a 48-inch load center, rough terrain	x	x			
Truck, forklift, 2,500-pound capacity, rough terrain ^c	x	x			
Truck, container handler, self-sideload, with adjustable top handler for 20- to 40-foot containers ^d	x				
Crane, mobile, capable of handling 20- to 40-foot containers	x ^e	x ^f			
Ramp, loading, mobile, container loading, 16,000-pound capacity ^c	x	x			
<i>Transport equipment:</i>					
Semitrailer, dual-purpose break-bulk/container transporter, 34-ton, 40-foot	x ^g		x		
Truck tractor, commercial, line haul, 10-ton, 6x4			x		
Semitrailer, tactical, dual purpose break-bulk/container transporter, 22½-ton		x	x		
Semitrailer, tactical, special purpose, self-load/unload container transporter, 22½-ton ^h			x	x	x

¹ Although not listed in table 3-1, the helicopter, when employed to discharge a container ship, may also be considered as an item of container handling equipment. Its employment in this capacity is discussed in chapter 11.

Table 3-1—Continued

Equipment	Terminal service company (container)	Terminal transfer company	Medium truck company	Light-medium truck company	Motor transport company
Truck tractor, 5-ton, 6x6		x	x	x	x
Truck tractor, yard type i	x				
Supporting equipment j	x	x			

^a The listing and discussion of equipment includes several items that are not yet in the Army system but are planned for development or for future procurement from commercial sources.

^b For use in LOTS operations only.

^c Also authorized in team JC (TOE 55-560), freight consolidation and distribution point. The capacity of 2,500-pound forklift may be revised to 4,000 pounds as a result of continuing developmental efforts..

^d For use at a fixed port.

^e For use in LOTS operations and within the port / marshaling complex.

^f When operating inland waterway transfer point.

^g When used as a yard trailer.

^h Assigned to divisional and / or nondivisional transportation truck units as required.

ⁱ Also authorized in team GF (TOE 55-540), trailer transfer point operations.

^j Forklift attachments, crane attachments, lifting devices, slings, and other specialized equipment.

- By selection of off-the-shelf items, or

- Through the program of military adaptation of commercial items which, within limitations on expenditure of research and development funds, permits modification of a commercially available item to fit the military requirement.

However, equipment required for military operations does not always have a civilian counterpart; for example, commercial equipment generally does not have the high flotation characteristics required in a beach environment during a LOTS operation or a rough terrain capability for use in unimproved areas.

Section II. MATERIALS HANDLING EQUIPMENT

3-3. Forklift, Frontloader, 50,000-Pound-Capacity

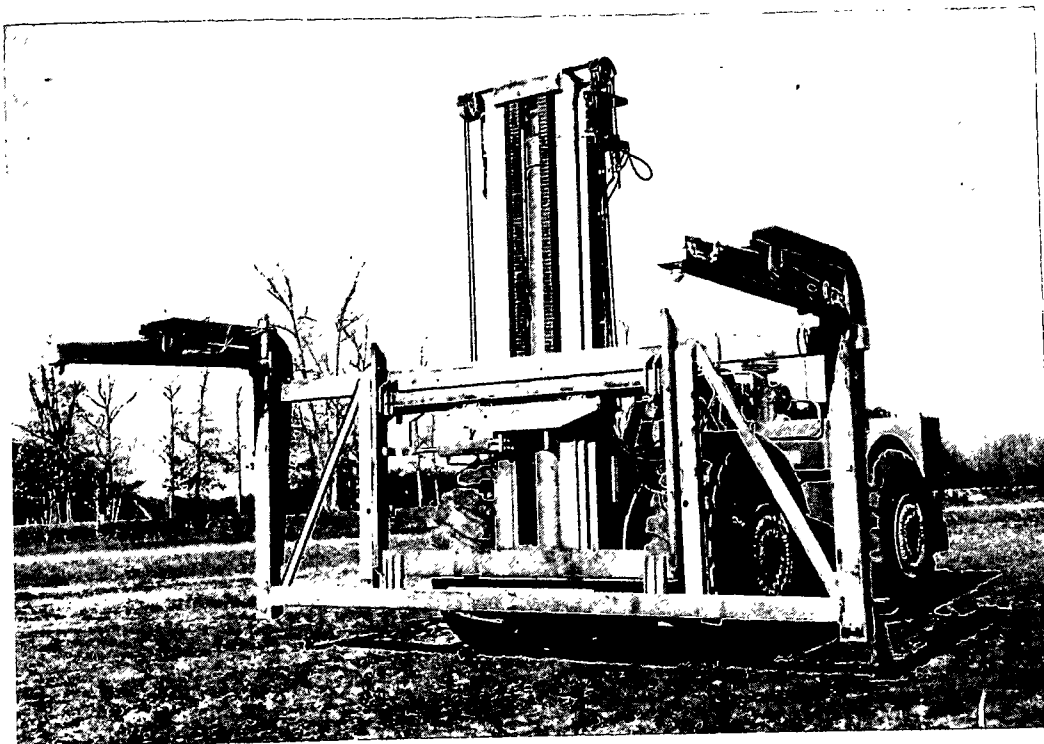


Figure 3-1. This shows a frontloader of the general type required by the Army for handling containers in terminal and marshaling area operations. Army requirements, however, call for a more versatile piece of equipment—one that not only stacks 50,000-pound loads two-high but also handles container lengths from 20 to 40 feet. The top-lift attachment must be detachable to permit use of tine forks when desired. (US Army photograph.)

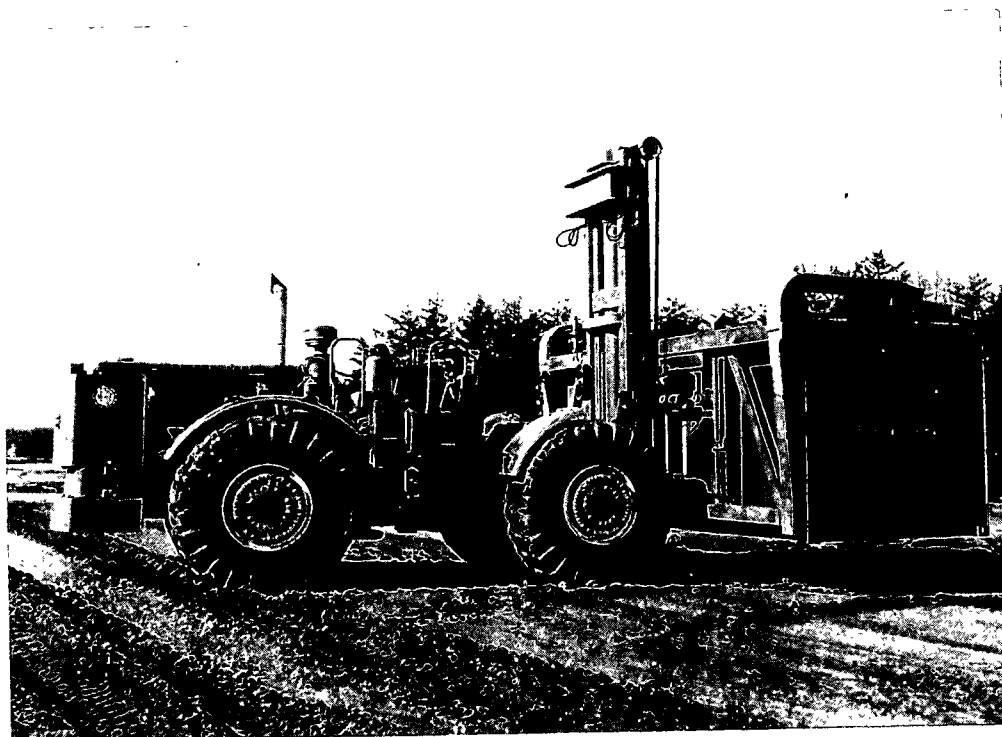


Figure 3-2. Same frontloader forklift as shown in previous figure. Here the top-lifting attachment is engaged with corner fittings of a 20-foot ANSI/ISO standard container. (US Army photograph.)

FM 55-70

Characteristics and/or performance requirements:

- Handles 20- to 40-foot containers to a maximum weight of 50,000 pounds.
- Can stack containers two-high.
- Is capable of sustained operations over rough terrain.
- Has 72-inch-long fork tines.
- Has detachable top-lift attachment.
- Has a side shift with oscillating and tilting mast capability.

Employment:

• Loads container onto, or removes container from, item of line haul equipment.

• In a LOTS operations, lifts container from a beach transporter at the beach marshaling area and loads container onto a line haul semitrailer.

• Loads container onto, or removes container from, a yard semitrailer.

Assignment: Authorized in the—

• Transportation terminal service company (container).

• Transportation terminal transfer company.

3-4. Forklift, 15,000-Pound-Capacity



Figure 3-3. A frontloading forklift for handling TRICON modules and CONEXes. The equipment shown is lifting an 8x8x6½-foot container by fork tines. Not illustrated here is an added Army requirement for top lift to be accomplished by a detachable top-lifting attachment. Also required is a rough terrain capability to permit operation over unimproved terrain and beach soil (Picture courtesy of Allis-Chalmers.)

Characteristics and/or performance requirements:

- Handles TRICON modules and CONEXes.
- Is capable of two-high stacking.
- Is capable of sustained operations over rough terrain.

• Has 76-inch-long fork tines.

• Has a top-lift attachment.

• Has a side shift with oscillating and tilting mast capability.

Employment: Used to handle TRICON modules and CONEXes in the same operational environment as the 50,000-pound forklift.

Assignment: Authorized in the—

- Transportation terminal service company (container).

- Transportation terminal transfer company.

3-5. Forklift, 2,500-Pound-Capacity



Figure 3-4. This forklift is generally typical of the type required for container stowing and unstowing operations. An added capability not provided by the equipment shown here is that of operating over rough terrain. (Picture courtesy of White Materials Handling Division, a division of White Motor Corporation.)

Characteristics and/or performance requirements:

- Handles pallets, container inserts, and break-bulk supplies.
- Is capable of entering and working within the family of 8-foot-wide 8-foot-high containers.
- Is capable of sustained operations over rough terrain.
- Has a side shift capability.

Employment: This forklift is used to load cargo into and unload cargo from the family of 8-foot-wide 8-foot-high containers, including the TRICON modular container. It is used by transportation terminal service units and ter-

minal transfer units to remove cargo from damaged containers and place the cargo in usable containers, by transportation freight consolidation and distribution detachments at consolidation and distribution points, by supply units in forward unimproved depot areas, and by user units.

Assignment: Authorized in the—

- Transportation terminal service company (container).
- Transportation terminal transfer company.
- Transportation team JC (TOE 55-560), freight consolidation and distribution point.

3-6. Truck, Container Handler, Self-Sideload

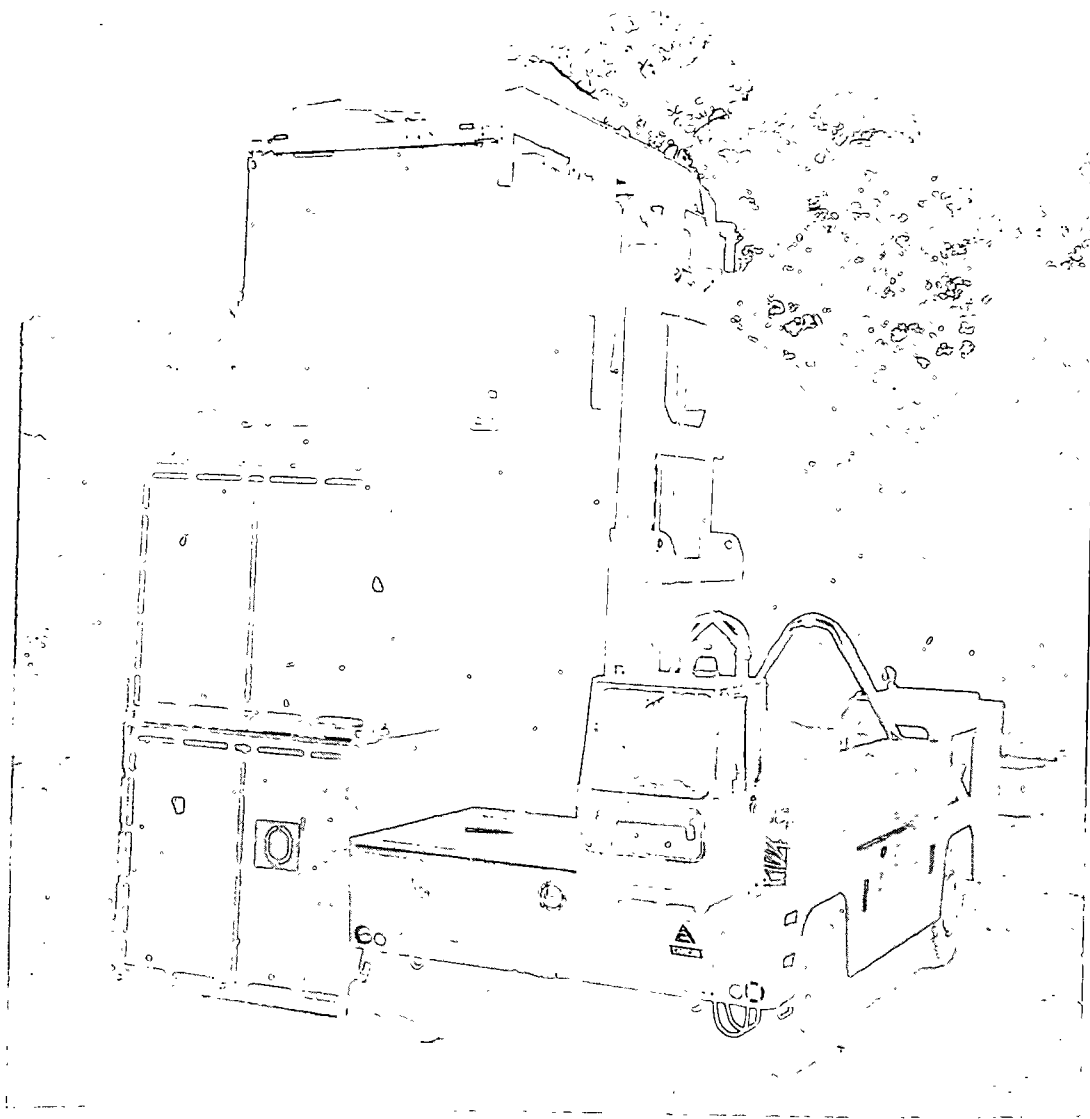


Figure 3-5. This self-sideloading container handler is illustrative of the type required by the Army for use in the container marshaling area, primarily at terminals. The Army sideloader, however, requires only a two-high stacking capability for loaded containers. (US Army photograph.)

Characteristics and/or performance requirements:

- Handles 20- to 40-foot containers.
- Has an over-the-road capability.
- Has limited offroad capability.
- Has a detachable top-lift attachment to permit handling of 20- to 40-foot containers.
- Has a two-high stacking capability for both loaded and empty containers.
- Provides unobstructed operator vision to

permit operator to observe and align containers.

Employment: Used to—

- Offload containers from the yard semitrailer and stack them in the marshaling area.
- Load containers on an item of line haul equipment.

◦ Transfer containers from one mode to another; for example, from rail to truck.

Assignment: Authorized in the transportation terminal service company (container).

3-7. Mobile Crane



Figure 3-6. This mobile crane, depicted in a dockside operation, can handle 30 short tons at a 100-foot radius or 250 short tons close-in. It is capable of extracting a container from a container cell on the far side of a container ship. (Picture courtesy of Harnischfeger Corporation.)

Characteristics and/or performance requirements: A requirement exists for a mobile crane, the characteristics of which have not yet been determined. Generally, it will be required to—

- In a dockside operation, extract a 40-foot container from a cell on the far side of the container ship.
- In a LOTS operation, extract a 20-foot container from a container cell.

Employment:

- Used in the conventional manner in operations at a fixed port or an inland waterway transfer point.

- In discharging or backloading ships during a LOTS operation, may be employed—

- Aboard the container ship, or
- Aboard a lighter or floating DeLong pier moored alongside the container ship, or
- Aboard an auxiliary hull made fast to the container ship, or

Shoreside at water's edge to transfer containers between land transport and trans-hydro craft (lighterage).

Assignment: Authorized in the—

- Transportation terminal service company (container).
- Transportation terminal transfer company.

3-8. Mobile Loading Ramp

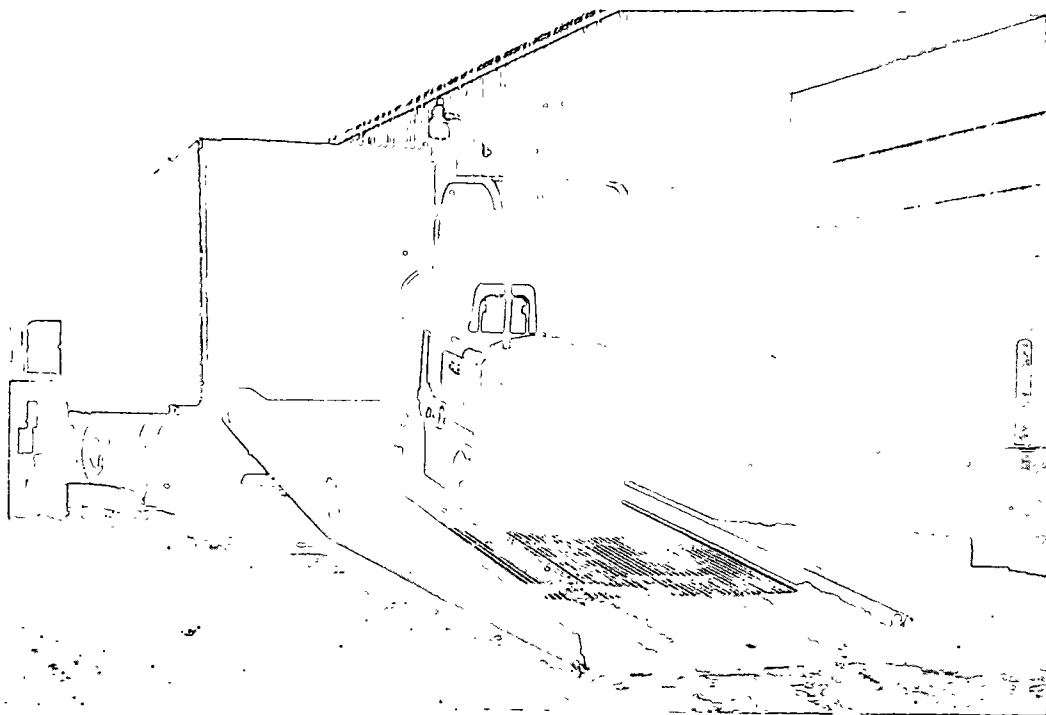


Figure 3-7. A mobile ramp is used to permit entry of the forklift truck into the container during stowing and unstowing operations. A ramp eliminates the requirement for loading docks or for demounting the container from the chassis. (Picture courtesy of Brooks and Perkins, Incorporated.)

Characteristics and/or performance requirements:

- Is capable of sustaining loads up to 16,000 pounds.
- Has a ramp angle compatible with forklift truck entry into container.
- Is capable of being manually positioned by two persons.
- Is towable over the road.
- Has a limited capability for being towed offroad.

- Has a ramp surface of nonskid material.

Employment: Provides the means for materials handling equipment to enter a container mounted on a semitrailer or chassis.

Assignment: Authorized in the—

- Transportation terminal service company (container).
- Transportation terminal transfer company.
- Transportation team JC(TOE 55-560), freight consolidation and distribution point.

Section III. CONTAINER TRANSPORT EQUIPMENT

3-9. Use of Motor Transport

Motor transport accomplishes a portion of container movement from water terminals to general support supply activities (GSSA's) and the major part of container movement from

GSSA's forward. Both commercial design and military design equipment is used to move containers in a theater of operations but, as a general rule, motor transport of containers to the rear of the division area boundary is by commercial type equipment.

3-10. Dual Purpose Break-Bulk/ Container Transporter, 34-Ton

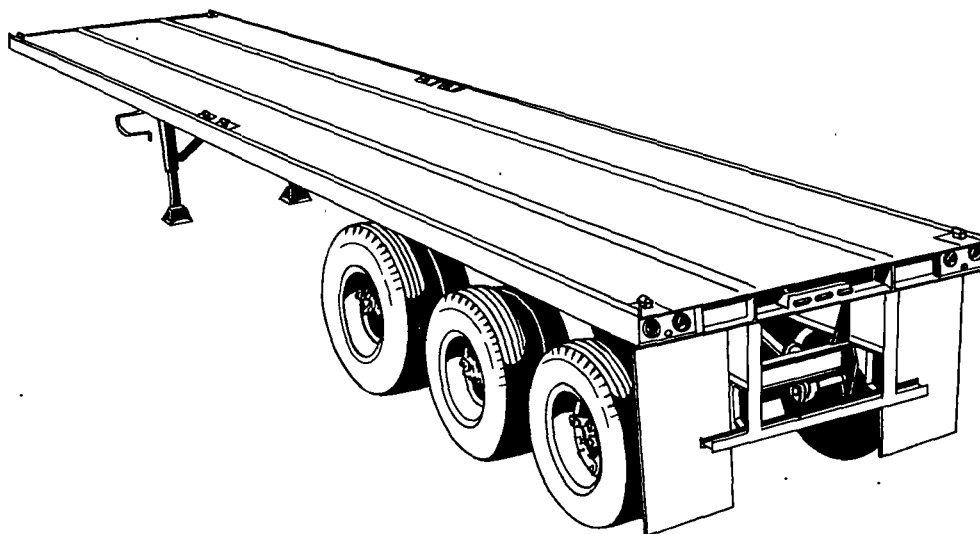


Figure 3-8. Artist's sketch showing the dual-purpose 34-ton break-bulk/container transporter. This transporter has built-in ANSI/ISO standard twist locks that permit it to carry any combination of containers (including the TRICON) not exceeding 40 feet in length. An integral platform type bed enables the transporter to also carry break-bulk cargo or any combination of break-bulk cargo and containers that does not exceed the 40-foot-length limitation. The transporter is compatible with both military and commercial design truck tractors.

Characteristics and/or performance requirements:

- Can carry containers up to 40 feet in length or any combination not exceeding 40 feet in length (including the TRICON modular containers), with maximum payload not exceeding 68,000 pounds.
- ISO twist locks are built into the transporter bed to secure containers up to 40 feet in length, including the TRICON modular containers.
- Has provisions for securing break-bulk cargo and CONEX containers.
- Has an integral flatbed for moving break-bulk cargo.
- Is compatible with the fifth wheel of military and commercial design truck tractors.

- Has an electrical system compatible with military and commercial design truck tractors.
- Operates on primary and secondary roads and has a limited offroad capability.

Employment:

- Used in line haul and local haul of containers, break-bulk cargo, or a combination of container and break-bulk cargo.
- Employed for in-theater movement from port terminals to the corps GSSA's and, on a selected basis, to direct support supply activities (DSSA's) and/or division support commands (DISCOM's).

Assignment: Authorized in the transportation medium truck company or as otherwise required.

3-11. Commercial Truck Tractor, Line Haul, 6x4

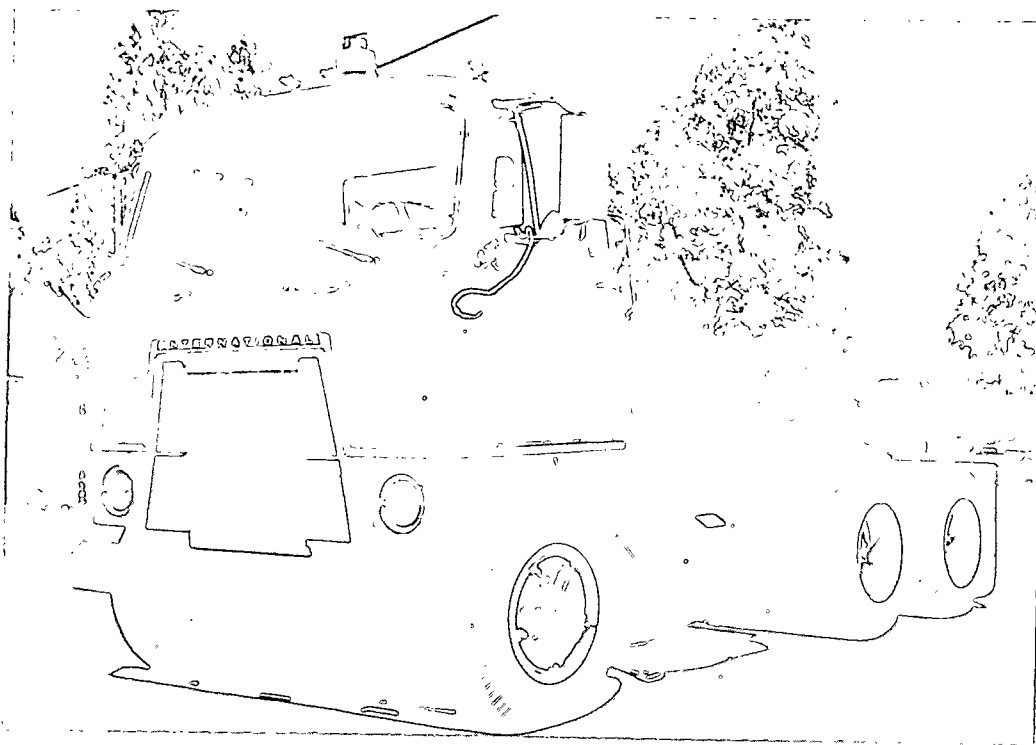


Figure 3-9. A commercial design 6x4 truck tractor is used primarily to pull the 34-ton break-bulk/container transporter in line haul and local haul of cargo within the theater of operations. Organic to the transportation medium truck company, this truck tractor is compatible with both military and commercial design semitrailers. It normally operates over hard-surfaced primary and secondary highways. (Picture courtesy of International Harvester Company, Incorporated.)

Characteristics and/or performance requirements:

- Is capable of pulling semitrailer loads, including break-bulk cargo and containers up to 40 feet in length, at sustained high speeds.
- Operates primarily over hard-surfaced primary and secondary highways.
- Electrical and brake systems and height of fifth wheel are compatible with commercial and military semitrailers.

Employment:

- Used primarily to pull the 34-ton semitrailer break-bulk/container transporter described in paragraph 3-10.
- Accomplishes line haul and local haul for cargo movement within the theater of operations from shoreside to as far forward as the GSSA or as far forward as road conditions and the operational environment permit.

Assignment: Authorized in the transportation medium truck company.

3-12. Dual Purpose Tactical Break-Bulk/ Container Transporter, 22½-Ton

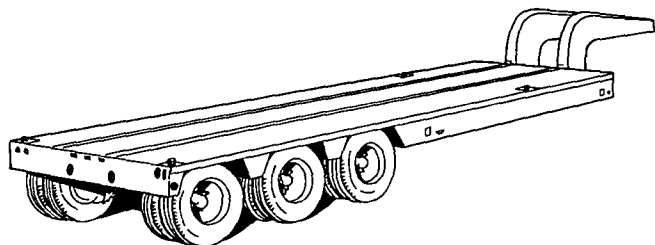


Figure 3-10. Artist's concept of the dual purpose 22½-ton tactical break-bulk/container transporter. This transporter will provide tactical support mobility not attainable with the 34-ton transporter. In addition to locking devices for securing 20-foot and TRICON containers, the 22½-ton transporter also has an integral platform bed and tiedown devices that permit it to carry break-bulk cargo. Organic to the transportation medium truck company, the transporter can carry any ANSI/ISO standard 20-foot container, or three TRICON modular containers weighing up to 15,000 pounds each, or a combination of break-bulk cargo and TRICON's not exceeding 20 feet in length or 45,000 pounds in weight. The transporter is compatible with both the military standard 5-ton and the commercial 10-ton truck tractors.

Characteristics and/or performance requirements:

- Provides tactical support mobility; that is, occasional offroad movement over selected terrain.
- Is capable of transporting any ANSI/ISO standard 20-foot container weighing up to 44,800 pounds, or three TRICON modular containers weighing up to 15,000 pounds each, or any

combination of break-bulk cargo and TRICON's weighing not more than 45,000 pounds and not exceeding 20 feet in length.

- Has an integral flatbed for the movement of break-bulk cargo.
- Incorporates locking devices for securing 20-foot and TRICON containers and tiedown devices for securing break-bulk cargo.
- Is fitted with removable side racks that are interchangeable with racks on the 34-ton break-bulk/container transporter described in paragraph 3-10.
- Kingpin height is compatible with the military standard 5-ton and commercial 6x4 truck tractors.
- Electrical and brake systems are compatible with the military standard 5-ton and commercial 6x4 truck tractors.

Employment:

- Transports the 20-foot container, to include the following types—
 - Dry cargo
 - Refrigerated
 - Ammunition
 - TRICON
 - Transports break-bulk cargo or break-bulk/TRICON combinations not exceeding 20 feet in length.
 - Accomplishes delivery of cargo from corps GSSA's to DISCOM's and ultimate consignees and retrograde movement back to the GSSA's.
 - Delivers TRICON modular container to units in the division area having handling equipment to demount the container.
 - Accomplishes line haul in clearance of fully loaded 20-foot containers (such as ammunition containers) from port area.
 - The prime mover is normally the military 5-ton tractor (para 3-14).
- Assignment: Authorized in the—
- Transportation terminal transfer company.
 - Transportation medium truck company.
 - Selected truck units in the communications zone and corps areas.

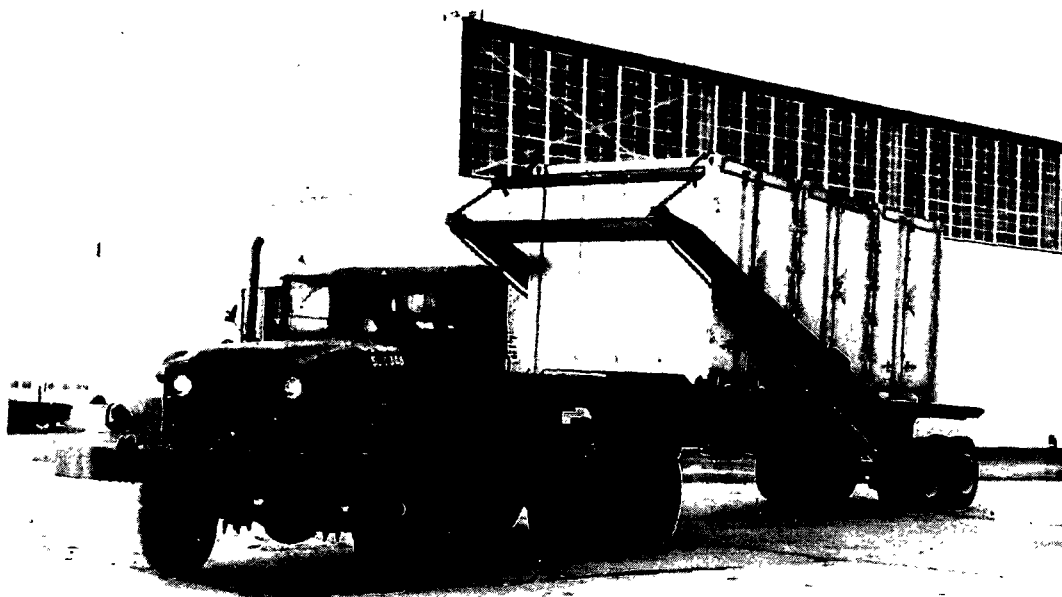


Figure 3-11. The special purpose tactical self-load/unload container transporter is used between supply facilities in DSSA's and DISCOM's and consignees at brigade and battalion level. The transporter, where materials handling equipment is required but not available, provides a capability to load, transport, and unload TRICON containers, 20-foot containerized shelters, and/or break-bulk cargo. Pulled by the 5-ton military or the 10-ton commercial tractor, the transporter possesses an offroad mobility equivalent to that of the 5-ton tractor. (US Army photograph.)

Characteristics and/or performance requirements:

- Can self-load/unload individual loaded TRICON modular containers, 20-foot containerized shelters, and break-bulk cargo; load/unload capability is limited to 15,000 pounds.

- Has a payload of up to 45,000 pounds consisting of either—

- Three individual TRICON modular containers, or

- Break-bulk cargo, or

- An 8x8x20-foot containerized shelter, or

- A combination of TRICON containers and break-bulk cargo.

- Integral transporter deck permits transporting bulk cargo.

- Containers are secured by standard AN-SI/ISO locking devices; break-bulk cargo is secured by tiedown devices.

- Has an offroad mobility equivalent to that of the 5-ton military tractor.

- Kingpin height and capacity are compatible

with the fifth wheel of 5- and 10-ton military tractors.

- Electrical and brake systems are compatible with 5- and 10-ton military tractors.

- Cargo handling system is compatible with the US Air Force 463L cargo handling system.

Employment: Where materials handling equipment is required but not available, is used in lieu of the 20-foot dual purpose tactical semitrailer (para 3-12) between supply facilities in DSSA's and DISCOM's and consignees at brigade and battalion level, primarily to—

- Deliver and demount individual loaded TRICON containers.

- Load, transport, and unload the 8x8x20-foot containerized shelter.

- Pick up and retrograde empty TRICON and 20-foot containers.

- Transport break-bulk cargo.

Assignment: Authorized in transportation medium and light-medium truck companies in corps and in the transportation motor transport company of a division.

3-14. Military Truck Tractor, 5-Ton, 6x6

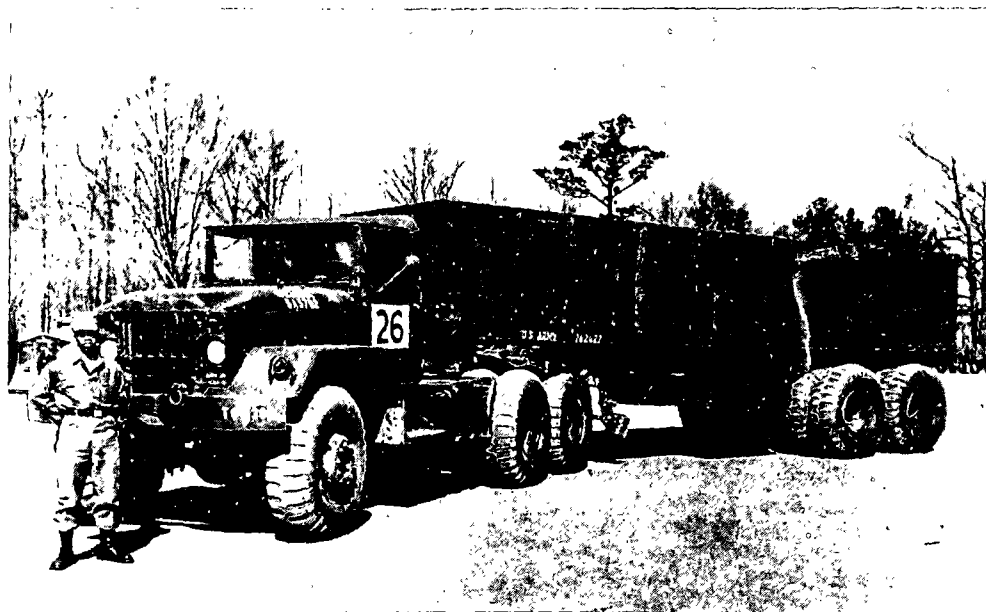


Figure 3-12. The 5-ton military truck tractor provides the offroad movement capability in varying degrees required during the transport of cargo from corps GSSA's and DSSA's to DISCOM's and to consignees at brigade and battalion level. The tractor will be used primarily to pull the 22½-ton dual purpose and the 22½-ton special purpose tactical container transporters. (US Army photograph.)

Characteristics and/or performance requirements: The military truck tractor differs from the commercial truck tractor primarily in that—

- Has a tactical support capability that permits offroad movement over selected terrain.
- Provides all-wheel drive capability.

Employment: Used primarily to pull the 22½-ton dual purpose (para 3-12) and the 22½-ton special purpose (para 3-13) tactical container trans-

porters in the movement of cargo from corps GSSA's and DSSA's, respectively, to the DISCOM and to consignees at brigade and battalion level.

Assignment: Authorized in transportation medium and light-medium truck companies in corps and in the transportation motor transport company of the division.

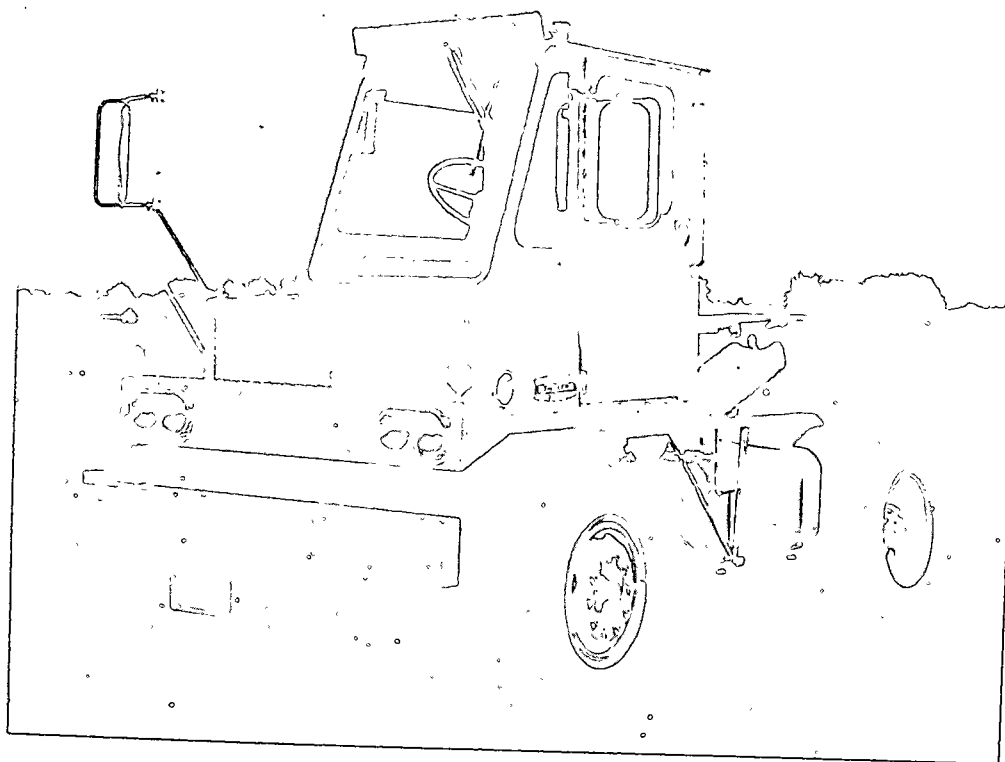


Figure 3-13. The yard tractor is used to move and spot containers within terminal areas and at transfer points. Primary uses are the movement of containers between shipside and the marshaling area and the movement of semitrailers in roll-on/roll-off operations. A hydraulic-lift fifth wheel permits movement of container transport semitrailers at maximum rated payload (up to 67,200 pounds) over even terrain with landing legs extended, or over roll-on/roll-off ship exit/entrance ramps. The driver can control the lift from the cab. (Picture courtesy of Daybrook-Ottawa Division, Gulf and Western Metals Forming Company.)

Characteristics and/or performance requirements:

- Tows the 34-ton container transporter (para 3-10) with payloads up to 67,200 pounds.
- Has sufficient mobility to move maximum towed loads within both the fixed sport/marshaling area and the semitrailer transport environment (tactical support mobility).
- Hydraulic-lift fifth wheel permits movement of container transport semitrailers at maximum rated payloads over even terrain with transporter landing legs extended; driver can control the lift from the cab.
- Fifth wheel is compatible with container transporter semitrailers.
- Fifth wheel can be locked and unlocked to semitrailer kingpin by driver in the cab.
- May possess all-wheel drive capability.

Employment: Used primarily—

- To move container yard transporters within a fixed-port terminal area, normally between shipside and the marshaling area.

- To move semitrailers in port roll-on/roll-off operations.

- At trailer transfer points and truck terminals, to spot container transport semitrailers for pickup by line haul truck tractors.

Assignment: Authorized in the—

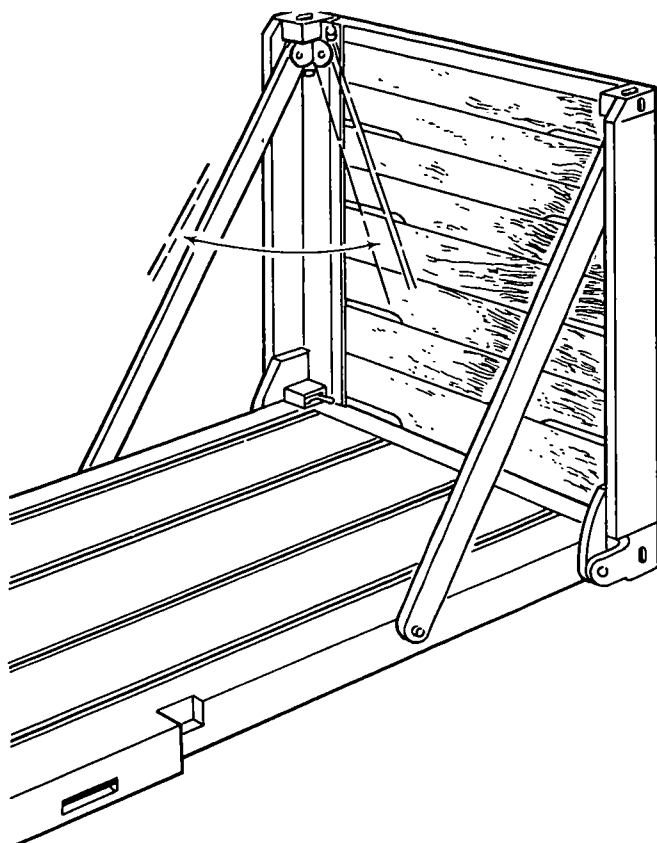
- Transportation terminal service company (container).
- Transportation team GF (TOE 55-540), trailer transfer point operations.

3-16. Yard Trailer

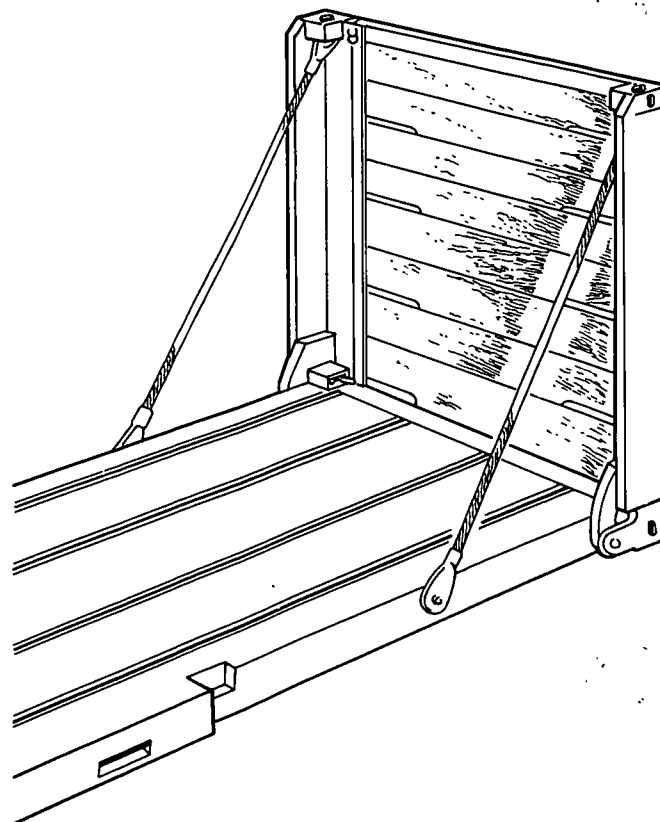
Characteristics and/or performance requirements:

In addition to using the dual purpose 34-ton break-bulk/container transporter (para 3-10) as a line haul vehicle, the Army will also use it as a yard trailer.

To adapt it for use as a yard trailer, the transporter is modified by installing container guides at each corner of the transporter deck. The guides aline the container with the transporter



Artist's sketch showing folding flatrack container with optional folding braces.
Figure 2-5—Continued.



Artist's sketch showing folding flatrack container with optional cable braces.
Figure 2-5—Continued.



Figure 2-6. A 40-foot flatrack container pulled by a commercial-model line haul 4 x 2 truck tractor. (US Army photograph.)

- **Flatrack container:**

Is basically a platform with corner posts.
 Has a floor bed with front and back ends or posts, but no sidewalls or roof.

Corner posts or ends are collapsible when flatrack is empty, thereby reducing shipping space required for empties.

Is particularly adaptable to unit moves

because it can carry some equipment and vehicles that are too wide to fit into 8-foot-wide containers but will fit into selected container cells.

Has same dimensions as other dry cargo containers, except that some flatracks are half height (4 feet high).

2-4. Special Purpose Containers

Following is a brief description of special purpose containers and illustrations of the most common types:

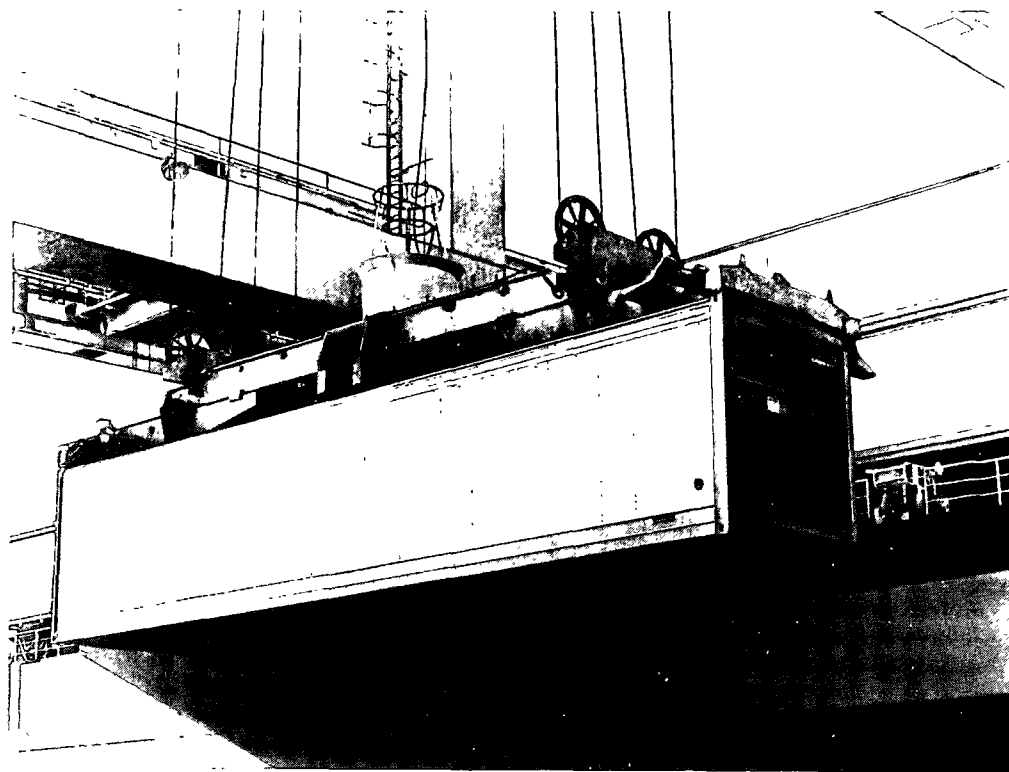


Figure 2-7. This refrigerated container is used for cargo that requires controlled temperatures. The refrigeration unit is visible on the forward end of the container. Refrigerated container service permits oversea movement of virtually any temperature-sensitive cargo, regardless of climatic conditions. (Picture courtesy of Fruehauf Corporation.)

- **Refrigerated container**—an insulated container with a refrigeration unit mounted internally or externally; has both refrigerating and heating capability:

Construction—normally constructed of aluminum, but may also be constructed of steel, plywood, plastic, fiberglass, or a combination of these; has hinged doors at the rear for stowing and unstowing cargo.

Cargo characteristics—cargo consists of commodities that require stabilization of internal temperature by refrigerating or heating. Typical cargo includes such commodities as frozen foods, fresh produce, electronic equipment, and medical supplies.

Cargo capacity—averages about 15 percent less than for the closed-top container because of insulation and requirement for air circulation around and/or within load.

Dimensions—same exterior dimensions as closed-top containers, but interior dimensions are reduced by insulation.

Refrigeration unit—refrigeration unit may have external source of power supply (electricity),

internal source (propane or other fuel-driven engine), or a combination of both to provide a self-contained unit capable of intermodal transportation.

- **Insulated/ventilated container**—an insulated container without the refrigeration unit; designed to prevent any wide temperature variance within the container:

Construction—basically the same as the refrigerated container; has hinged doors at the rear. Permits fresh air to circulate around the cargo and expel heat and gases; in extremely cold areas, when required, a heating element prevents freezing of cargo.

Cargo characteristics—cargo consists of sensitive or perishable cargo; for example, electronic equipment, certain medical supplies and drugs, batteries, or nonrefrigerated fresh vegetables and fruits.

Cargo capacity—averages about 10 percent less than for the closed-top container because of interior insulation.

Dimensions—interior dimensions approximately the same as refrigerated container.

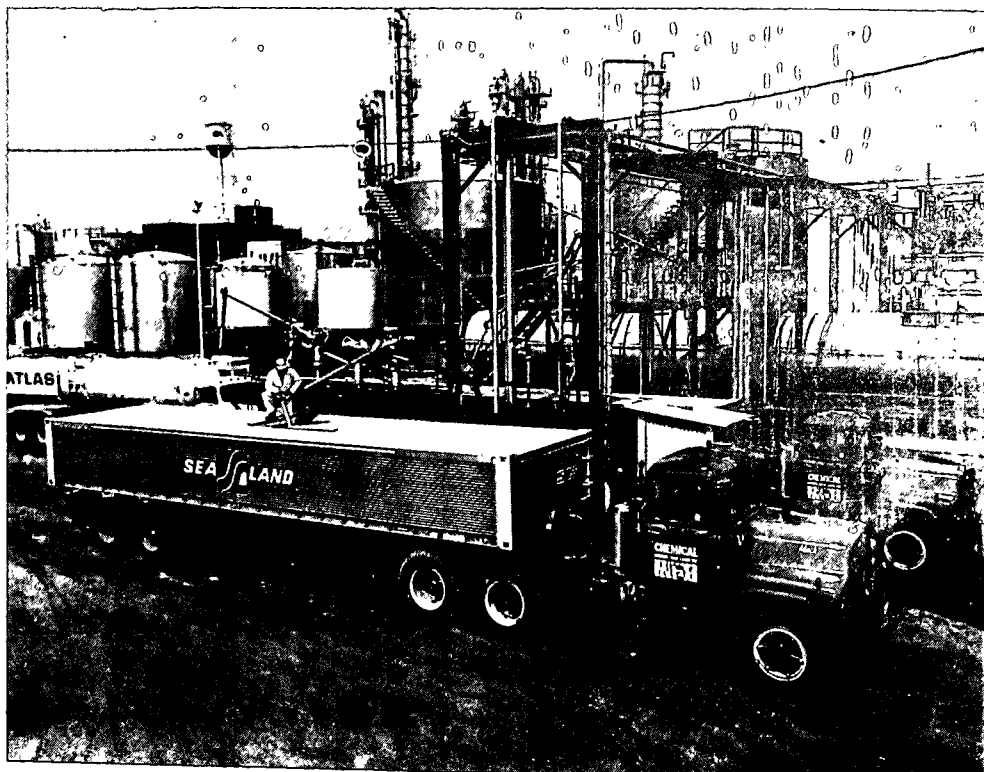


Figure 2-8. Bulk liquid container carries up to 5,000 gallons of liquid cargo or cargo capable of being liquefied. (Picture courtesy of Sea-Land Service, Incorporated.)

- **Bulk liquid container:**

Construction—normally constructed of stainless steel; interior insulated with fiberglass; container shell equipped with either single or twin barrel; has a 20-inch full-opening manhole for each barrel and a discharge valve at the rear. Heat panels permit reheating of contents.

Cargo characteristics—accommodates liquid cargo or cargo capable of being liquefied by heating. At least one of the commercial bulk liquid type containers is approved by the Department of Transportation and the US Coast Guard to handle over 200 products.

Cargo capacity—up to 5,000 US gallons.

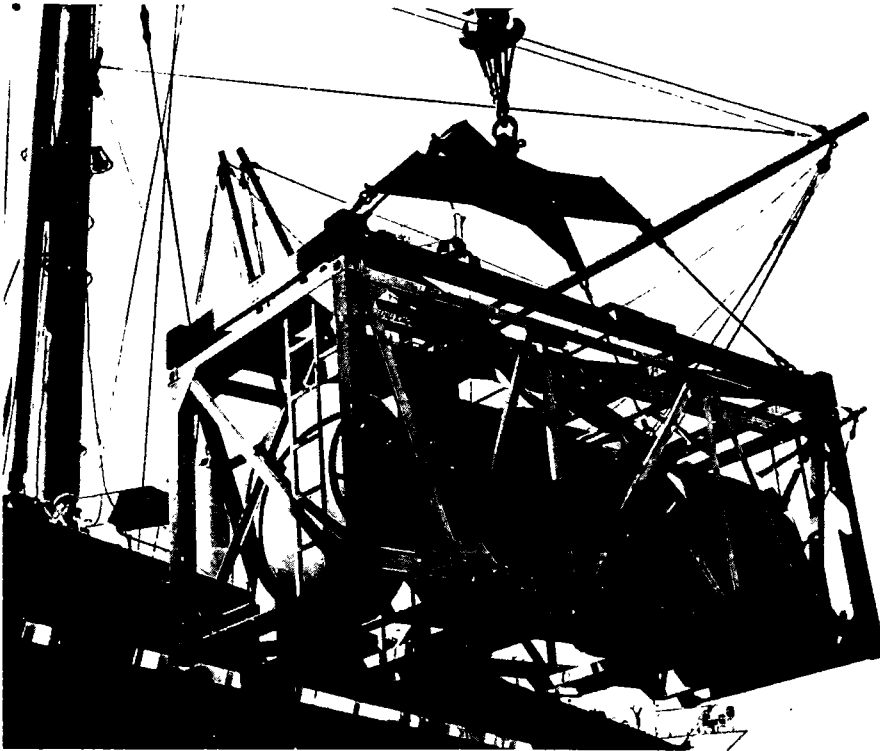


Figure 2-9. The primary difference between this bulk liquid container and the one shown in figure 2-8 is the external structure; that is, this container is mounted in a 20-foot frame. Capacity and utilization are basically the same for both types. (Picture courtesy of Fruehauf Corporation.)

Section II. THE CONTAINER AND AIR TRANSPORT

2-5. Air-Land Container—Commercial Airlift
Jumbo commercial aircraft, such as the Boeing 747 freighter, can carry ANSI/ISO air mode van-type containers up to 40 feet in length. However, because of the limited numbers of containers and aircraft that have this capability, it is not recommended that shipment normally be planned by this mode. There are two types of standards covering these containers: the ANSI/ISO

standards (para 1-6) and the SAE AS 832 standards.² *The AS 832 standards have not been approved for use by the US Air Force.*

The Society of Automotive Engineers has designed an air-land container in the sizes shown below that conforms to ANSI/ISO dimensional specifications but is lighter structurally than the surface container and has a reduced gross weight and payload rating. Structure of the container does not permit stacking in a container ship cell.

Size (ft)	Displacement (cu ft)	Capacity (cu ft)	Maximum gross weight (lbs)	Tare weight (lbs)	Payload (lbs)
8x8x40	2,560	2,090	45,000	3,600	41,400
8x8x30	1,916	1,703	35,000	2,800	32,200
8x8x20	1,272	1,040	25,000	1,900	23,100
8x8x10	628	490	12,500	1,000	11,500

2-6. Air-Land and Surface Container—Military Airlift

The Army-owned 20-foot military van

(MILVAN) container and 20-foot commercial containers can be transported by C-130, C-141, and C-5A aircraft.

² ANSI—American National Standards Institute; ISO—International Organization for Standardization; SAE—Society of Automotive Engineers.

deck and are arranged to receive either two 20-foot containers or one 40-foot container.



Figure 3-14. Here a commercial type yard trailer is in position to receive a container being discharged from a ship. The four devices extending upward from the trailer bed serve to receive the container and guide it into position on the trailer so that the container corner fittings match the locking devices on the trailer. This picture serves only to illustrate the design principle of the yard trailer since the Army does not plan to use the commercial type. Instead, plans call for the installation of corner container guide kits on the 34-ton dual purpose break-bulk/container transporter to be authorized in the transportation terminal service company (container) for use as a yard trailer. (Picture courtesy of Dorsey Trailers.)

Employment: Used with the yard tractor to move containers within the terminal area of the fixed port, primarily between shipside and the marshaling area.

Assignment: Authorized in transportation terminal service company (container).

Section IV. SUMMARY

The Army must assure that a US/NATO military controlled capability is available to meet operational requirements, and that this control

capability will, of necessity, include commercial containers—

- Existing commercial port handling facilities

may be destroyed, rendered inoperable, or their use denied by enemy action.

- The operational environment or the nonexistence of port facilities may require movement of containers over the beach. Commercial operators are neither equipped nor prepared for a logistics over-the-shore (LOTS) operation.

- Combat or contingency operations in the division support command, brigade, and battalion areas may require a degree of tactical mobility that cannot be provided by commercial operators.

- In a hostile environment, intratheater commercial container operations may be so severely restricted that they cannot provide the container support envisioned for the Army in the field.

Many military requirements for container handling equipment can be satisfied—

- Adoption of off-the-shelf items, or
- Modification of a commercially available item to fit the military requirement.

However, some Army-required equipment has no civilian counterpart; for example, high flotation equipment required for a LOTS operation or equipment with a rough terrain capability for use in unimproved areas.

The spectrum of Army-required *materials handling equipment* provides the capability, as appropriate, to handle 20-foot (including the TRICON) to 40-foot containers with lift capabilities ranging in weight from 2,500 pounds to a maximum of 67,200 pounds. Equipment is compatible with Army-owned and commercial ANSI/ISO standard containers. Employment of the equipment includes—

- Extracting containers from or placing containers in cells of non-self-sustaining container ships at dockside facilities or in the stream.

- Transferring containers between transportation modes at the water's edge in a LOTS operation and in ports, container marshaling areas, and inland trailer transfer points.

- Accomplishing the land portion of container movement between the discharge point and the container marshaling area.

- Unloading, stacking, and loading containers on transport equipment in the container marshaling area.

- Stowing and unstowing containers by transportation terminal service units and terminal transfer units, by transportation freight consolidation and distribution detachments at

consolidation and distribution points, by supply units in forward unimproved depot areas, and by user units.

Motor transport equipment accomplishes a portion of the container movement from water terminals to general support supply activities (GSSA's) and the major part of container movement from GSSA's forward. Both commercially designed equipment and military equipment designed for operations in an offroad environment are used to move containers in a theater of operations. Most military container transporters are compatible with commercial tractors, as are commercial transporters with military tractors; however, in some cases some problems may exist in the area of fifth wheel height and chassis pin alignment.

- As a general rule, motor transport of containers to the rear of the division area boundary is by commercial type vehicles, primarily in line haul of 40-foot containers, break-bulk cargo, or any combination of containers and/or break-bulk cargo not exceeding 40 feet in length and 67,200 pounds in weight.

- In the forward tactical area or in areas requiring offroad capability, military designed equipment is normally used to deliver cargo from the corps GSSA to the division support command and the ultimate consignee and to retrograde empty and loaded containers back to the GSSA.

- The military designed equipment transports—

- Any ANSI/ISO standard 20-foot container weighing up to 44,800 pounds, or—

- Three TRICON modular containers weighing 15,000 pounds each, or—

- Any combination of break-bulk cargo and TRICON's not exceeding 48,000 pounds in weight nor 20 feet in length.

- The special purpose tactical self-load/unload container transporter permits delivery of individual TRICON modular containers to forward area consignees who do not have the equipment required to load or unload containers.

- The yard tractor is authorized in the transportation terminal service company (container) primarily for movement of yard trailers within the terminal area of an oversea fixed-port/marshaling area. The yard tractor is also used in the trailer transfer point to position container transporters.

- The modified 34-ton break-bulk/container transporter is authorized in the transportation terminal service company (container) for use as a yard trailer.

CHAPTER 4

TRANSPORTATION MODES—EFFECT OF THE CONTAINER

4-1. General

Virtually the entire spectrum of transportation modes provides transit to the cargo container. Transport to destination may be by individual mode or, more likely, by multimodal movement. The degree of impact of containers depends primarily upon the characteristics of the various modes and varies with the capacities and capabilities of assigned transport and related handling equipment. From the carrying standpoint, little has changed: generally, the military transportation modes have always been able to handle large boxes. To the carrier, that's all that a container is. The handling of big boxes will become easier and more efficient as special equipment is developed and adopted by the Army. Advantages ensue from reduced requirements for time and labor in handling, sorting, and checking quantities of small unitized/palletized and loose items of cargo—all inherent to break-bulk procedures.

Containerization does not change any principles of transport or movement management. For example—

- Containers should move as far forward as possible on the initial (and subsequent) modes.
- Cross hauling should be avoided.
- Unnecessary mode changes must be avoided.

4-2. Ocean Transport

Containers can move aboard most cargo ships—however, the full advantages of the system are realized only aboard container ships. The two basic methods for loading containers for movement aboard ship are—

- Lift-on/lift-off
- Roll-on/roll-off

Lift-on/lift-off is by far the more popular method and may be accomplished by on-board cargo lifting gear (self-sustaining vessel) or by gear

located ashore or on adjacent ships or barges (non-self-sustaining vessel). Containers are usually moved aboard this type of vessel without a chassis attached and are deposited into specially designed vertical cells or stacked on deck and secured by special locking devices.

In a roll-on/roll-off operation (RORO), fully loaded trailers are driven aboard specially designed vessels, parked and secured for the sea voyage, and then driven ashore at the overseas terminal for movement to final destination. At the cost of high space utilization, RORO provides rapid discharge and the ability to carry not only trailers but tractors and other vehicles ready to haul trailers directly into the land line of communication. During the initial stages of entry into a theater, this feature is indeed significant. Most RORO vessels have a self-sustaining lift-on/lift-off capability; however, its use equates to regular cargo handling, and the speed advantage of RORO is sacrificed.

Ships Used in Container Transport:

Full container ships, partial container ships, and break-bulk ships (conventional ships) make up the major portion of the cargo fleet. New ships are being designed especially to carry containers. However, the first ships used to carry containers were conventional vessels converted to partial container (semicontainer) ships or to full container ships, normally self-sustaining; most of these were World War II vintage such as the C2 and T2, steaming well below 20 knots.

• Modern *full container ships* steam at 25 to 32 knots and *transport* 900 or more containers in a full range of sizes. The latest full container ships are *not self-sustaining*, resulting in reduced shipbuilding costs and increased cargo capacity. This is possible because equipped container ports are proliferating.

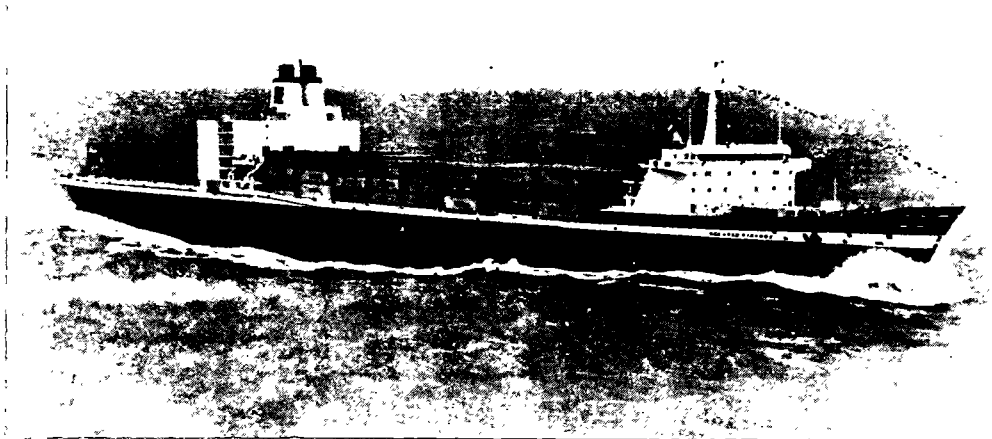


Figure 4-1. Shown here, the SS SEA-LAND FINANCE is one of Sea-Land's latest design full container ships. The vessel can carry 1,096 35- and 40-foot containers and at 120,000 horsepower, at a design draft of 30 feet, steams at 33 knots. (Picture courtesy of Sea-Land Service, Incorporated.)

- *Partial container ships* are equipped partly to handle containers and partly to handle break-bulk cargo. For statistical purposes, only those

ships with a capacity of at least fifty 20-foot containers are considered partial containers ships.



Figure 4-2. The SS JOSEPH LYKES is a self-sustaining partial container ship. In addition to its bulk cargo, the ship carries up to 167 8x8x20-foot containers. (Picture courtesy of Lykes Brothers Steamship Company, Incorporated.)

- *Conventional ships* can carry limited numbers of containers but only as conventional cargo—which means that for most vessels they are heavy lifts. Such vessels will not usually be employed to more military containers except to isolated, low volume consignees.

The commercial transportation industry has leaped into containerization. Since by national policy commercial industry provides segments of transportation to the military and since containerization is an interchange concept, the

military must have transport compatibility with industry. As the degree of commercial containerization increases, so also must military container capability.

Closely related to the container ship is the *lighter aboard ship (LASH)*. This system utilizes barges which act as the holds of the specially constructed ship. With the arrival of the LASH ship in port, the barges are placed in the water by the ship's crane either at a pier or offshore and are towed by tugs to their individual offload points.

Retrograde barges preloaded with cargo are then towed to the LASH, lifted aboard, stowed, and the ship is ready to sail. Approximately 15 minutes is required to load one barge aboard the ship. Utilizing a quick erecting and dismantling LASH container cell system, a LASH type ship

can be converted from a barge carrier to a container ship and vice versa within 12 hours without use of shipyard equipment. The ship can carry 61 barges (61x31x12 feet) or, with conversion, can carry 1,500 20-foot containers. The ship steams at approximately 22 knots.

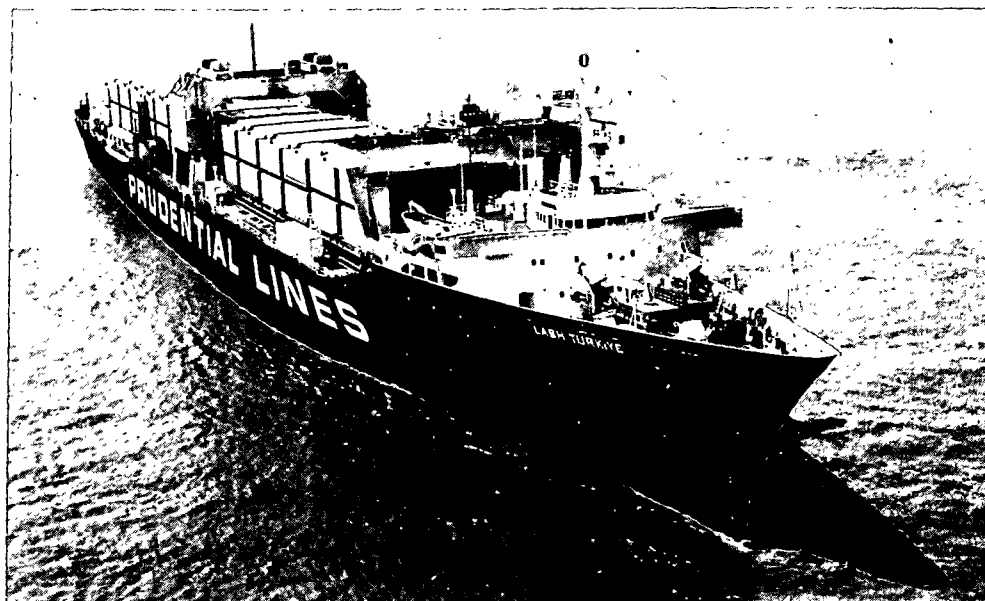


Figure 4-3. Ships of the LASH ITALIA group, of which the SS LASH TURKIYE is a member, are equipped to transport both barges and containers and have integral ship's gear to handle both. Stowed amidship is a 500-ton gantry crane for handling barges. Immediately aft of the bridge is a 60-ton gantry crane for over-the-side handling of containers. Barges are loaded and discharged over the stern. The ship can carry 61 barges (61x31x12 feet). With conversion, the ship can carry 1,500 20-foot containers. The barge concept offers a number of outstanding features—barges may be floated, for example, over inland waterways to points completely inaccessible to any type of oceangoing ship; empty barges may be picked up and loaded barges left to be picked up later, thereby drastically reducing ship port time; and, not least, the barge capacity (approximately 20,000 cubic feet or 400 short tons) provides a tremendous delivery capability for the time and labor expended in unloading one barge from the ship. (Picture courtesy of Lash Systems, Incorporated.)

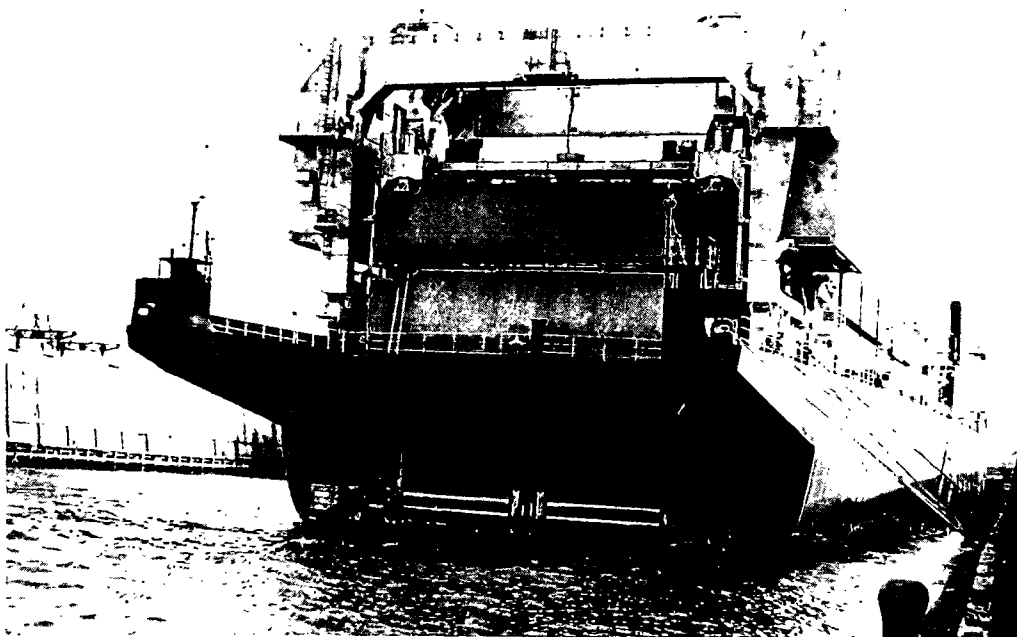


Figure 4-4. Here the LASH is discharging a barge. The load moves out over the aft well, and the crane then lowers the barge into the water where it is taken under tow by tug for delivery to the point where the cargo will be unloaded from the barge. (Picture courtesy of Prudential-Grace Lines.)

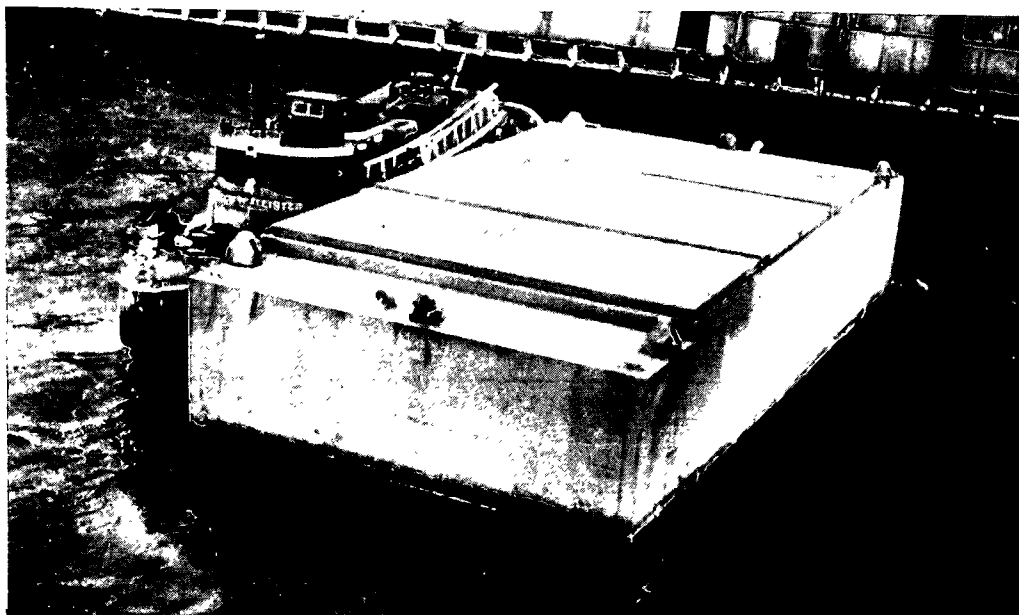


Figure 4-5. A LASH-type barge under tow. These relatively shallow draft barges extend ocean shipping services into otherwise inaccessible areas. (Picture courtesy of Defense Transportation Journal.)

The sea barge (SEABEE) system also uses barges which serve as the hold of the specially constructed ship. The SEABEE vessel can carry 38 of these barges, each measuring 97x35x17 feet, and each barge can carry 832 tons. The SEABEE

can also be loaded with 20-foot containers, 15 per barge; however, this employment is not normal practice. With conversion, the ship can carry 892 40-foot containers or 1,784 20-foot containers. The top speed of the vessel is 21.7 knots.

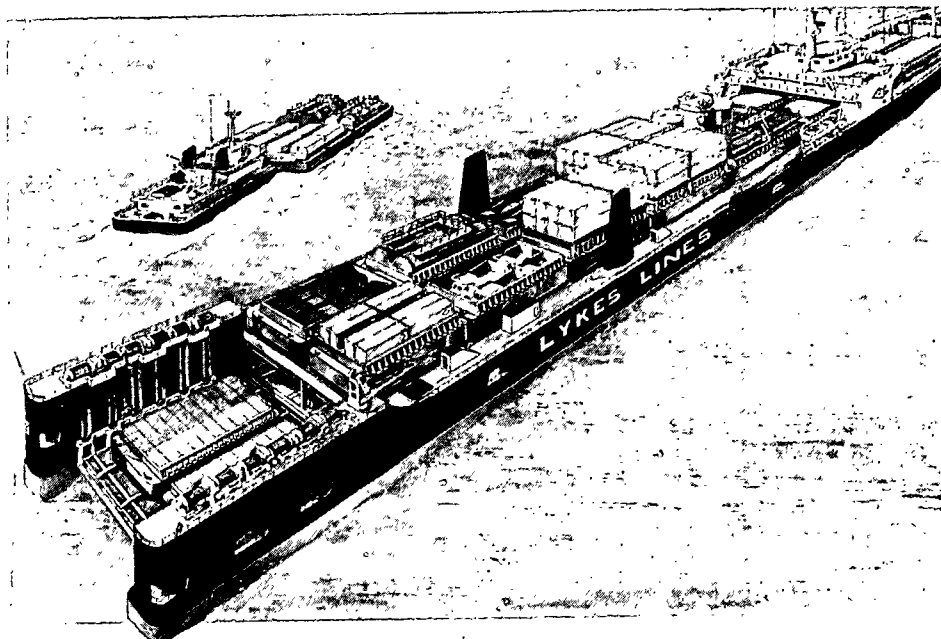


Figure 4-6. This artist's drawing of the SEABEE shows the 2,000-ton submersible stern elevator which lifts the SEABEE barges between the water and any one of the vessel's three horizontal decks. The elevator can handle two barges at one time and can load or discharge approximately 2,800 short tons of cargo per hour. Note the variety of cargo loaded on the SEABEE. In the background, loaded barges are being moved to shore destination. (Sketch courtesy of Lykes Brothers Steamship Company, Incorporated.)

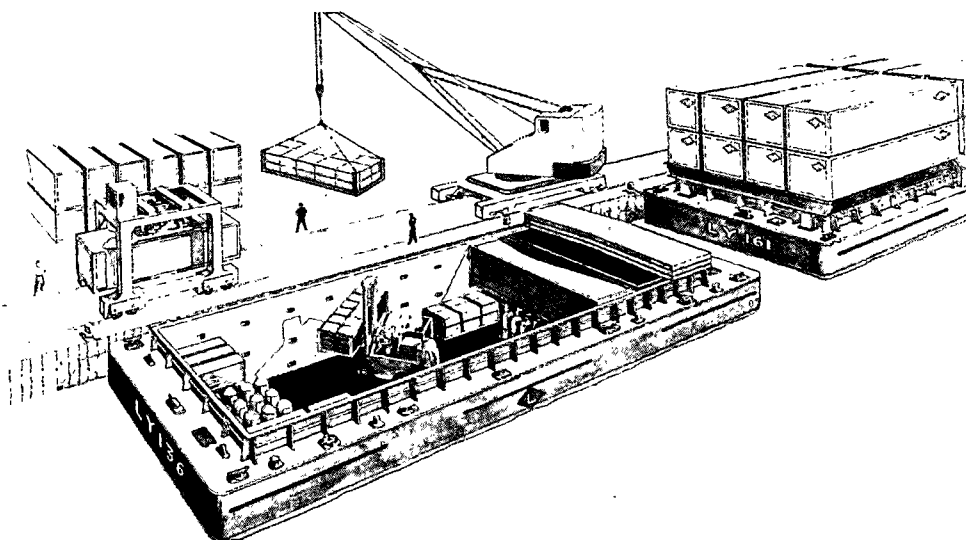


Figure 4-7. Artist's drawing shows the varieties of loads that may be placed in and on the SEABEE barge. (Sketch courtesy of Lykes Brothers Steamship Company, Incorporated.)

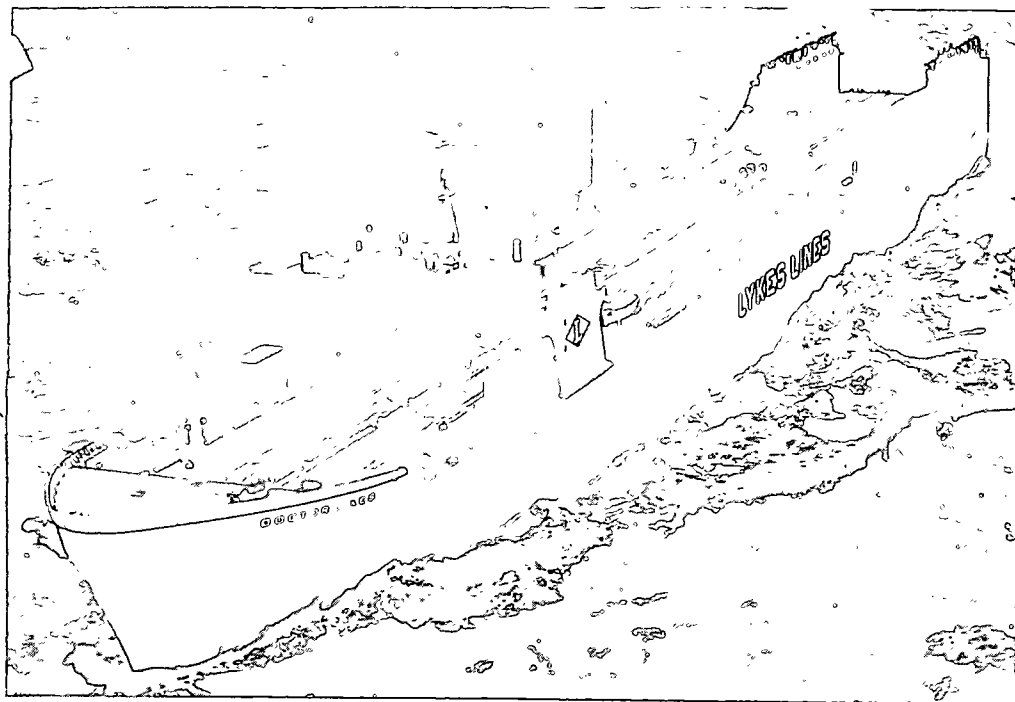


Figure 4-8. The first SEABEE to be placed in service: the USS DOCTOR LYKES. (Picture courtesy of Traffic World magazine.)

Roll-on/roll-off ships are a small but militarily important segment of the fleet. As already indicated, the fact that containers can be carried on

chassis from these ships straight into the line of communication is a great advantage in the early stages of theater development.

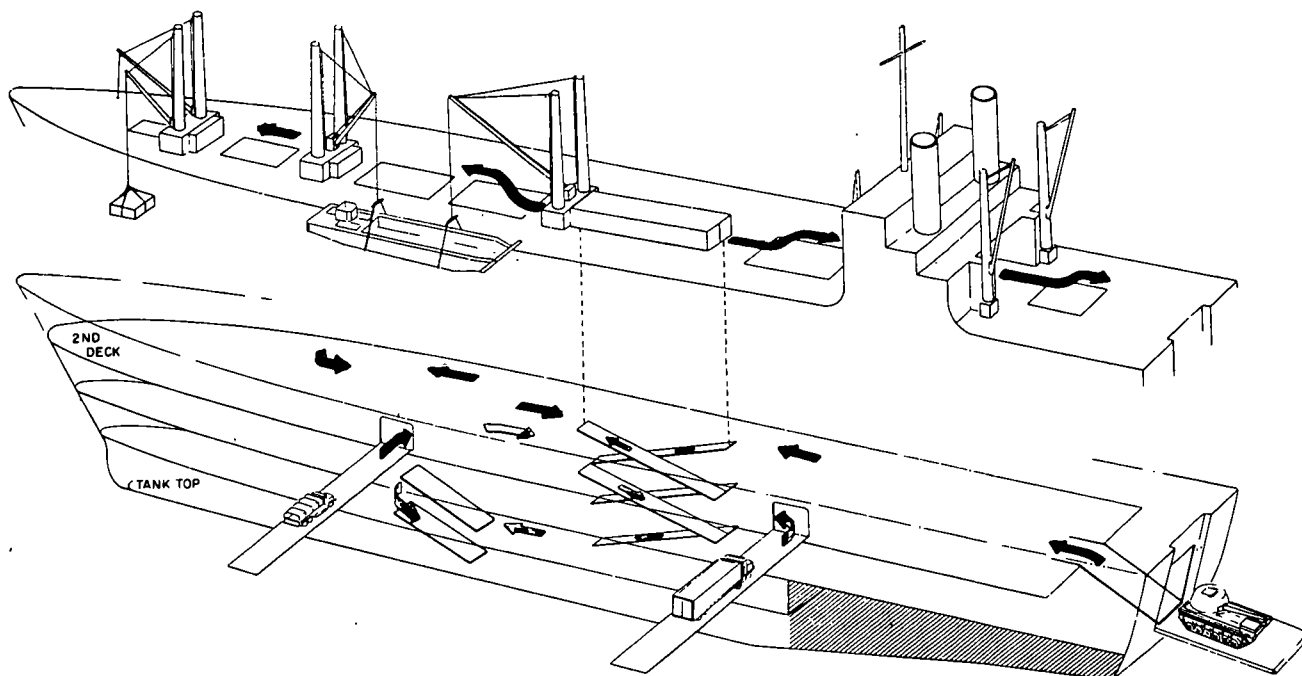
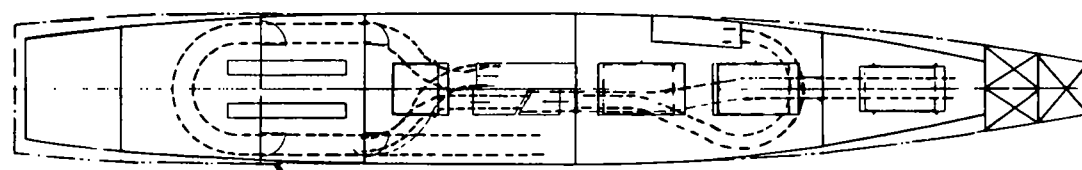
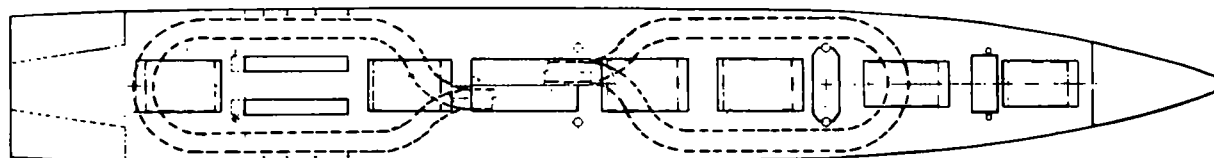
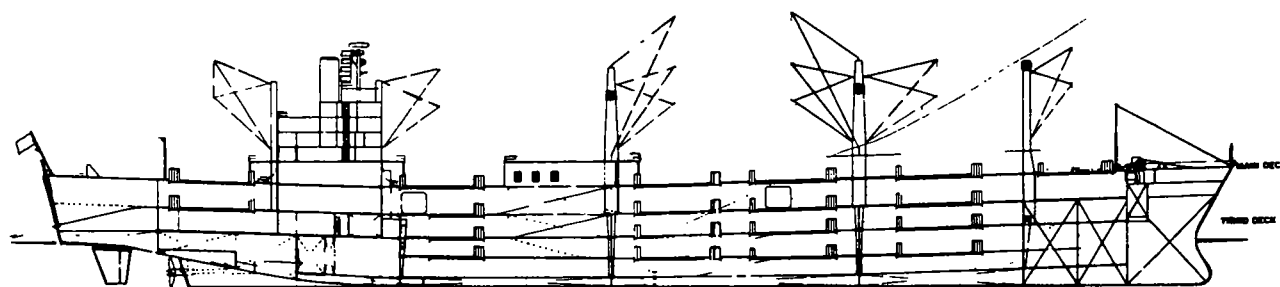
**CARGO TRAFFIC PATTERN****THIRD DECK****MAIN DECK****INBOARD PROFILE****PROFILES AND DECK PLANS**

Figure 4-9. This artist's sketch illustrates the principle of loading and unloading a roll-on/roll-off ship. Side ramps and/or bow and stern ramps permit vehicles to be driven aboard and ashore rapidly—in some types unloading and reloading has been accomplished in less than 5 hours.

Ocean Transport Availability:

The privately owned US merchant marine dry general cargo fleet currently numbers about 400 vessels. The profile of this fleet is continually changing, and forecasts of available shipping are at best conjectural. Standard cargo vessels,

special heavy lift vessels, and container ships can all be considered for the movement of containers. Table 4-1, compiled from Maritime Administration statistics, projects availability through 1976; the trend away from break-bulk ships is apparent.

Table 4-1. US Merchant Marine Fleet Composition Through 1976 (Projection)

Type ship	1972	1973	1974	1975	1976
a. Break-bulk	222	194	160	144	144
b. Container and special heavy lift vessels:					
Full container ship*	109	122	112	113	113
Partial container ship	22	22	20	20	20
LASH/SEABEE	10	17	22	23	25
Roll-on/roll-off	4	4	4	7	9
Total	<u>145</u>	<u>165</u>	<u>158</u>	<u>163</u>	<u>167</u>
Grand total	<u>367</u>	<u>359</u>	<u>318</u>	<u>307</u>	<u>311</u>

* It should be borne in mind that, because of the increasing size and speed of container ships currently entering the fleet, the total container lift capability is significantly greater than appears from table 4-1.

The President may proclaim a national emergency in the event of actual or threatened war and invoke emergency powers placing all resources of the nation, including the merchant marine, at the disposal of the Government. The Vietnam conflict pointed up inadequate controls in the event of lesser threats.

- The "Respond" program was an early DOD proposal to provide for Government availability of shipping in less-than-full emergency situations. Under "Respond," commercial operators would have been given a fixed proportion of annual DOD lift requirements at equitable rates in return for a commitment to make available an agreed-upon portion of their fleets under various stages of declared emergency.

- "Respond" has been superseded by the "Sealift Readiness Program," which specifies that an operator desiring a share of the DOD normal sealift business must commit up to 50 percent of his fleet at the call of the Commander, MSC. The MSC decision is made in consultation with the Maritime Administration and the Assistant Secretary of Transportation (International Affairs and Special Programs). Not only shipping space, but limited numbers of containers and chassis are included in the Sealift Readiness Program. While constantly fluctuating, this program currently assures that 80 break-bulk ships, 50 container ships, 2 LASH vessels, 25,519 containers of all lengths, and 19,315 chassis are available to the US Government for emergency use.

4.3. US Army Transportation Water Transport

US Army transportation watercraft provide water transport and floating utility services in harbor areas, on inland waterways, and along coastlines and provide ship-to-shore lighterage service in beach operations. The fleet consists of three basic types of floating equipment:

- Landing craft, which are designed primarily to transport wheel and track vehicles in logistics over-the-shore (LOTS) operations.

- Amphibians, which are wheeled floating craft designed to transport cargo from ships lying offshore to discharge points inland from the beach in LOTS operations.

- Harbor craft, which include numerous varieties of nonbeaching vessels such as tug boats, picket boats, and barge derricks designed for use in coastal and inland waterway operations. FM 55-50, when published, will give a full doctrinal discussion of Army water transport operations.

Current Organization:

The following Army water transport units have significant container lift capabilities:

- Transportation medium boat company (TOE 55-128).

- Transportation heavy boat company (TOE 55-129).

- Transportation heavy amphibian platoon (team FN, TOE 55-530).

- Transportation dry cargo barge platoon (team FL, TOE 55-530).

Each of these units has equipment that is capable of carrying at least one fully loaded container.

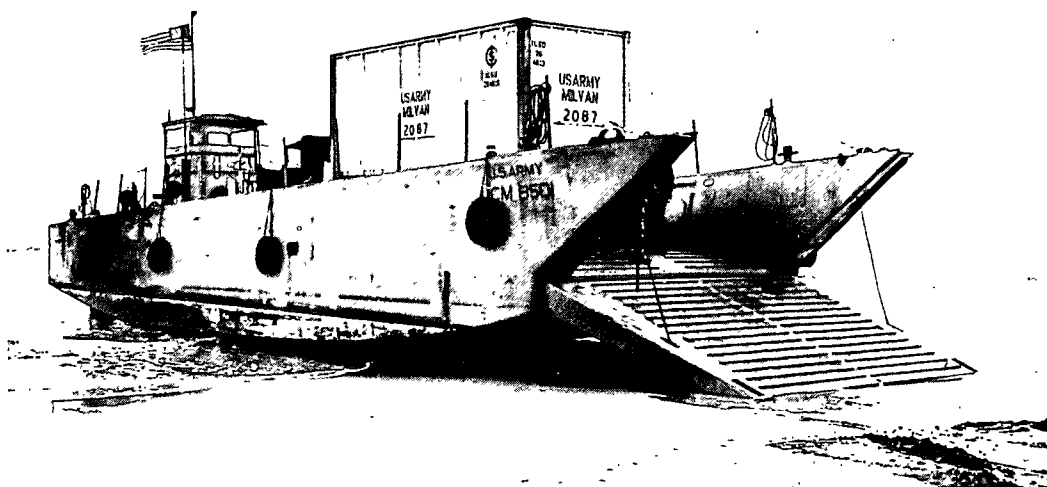


Figure 4-10. LCM-8. The transportation medium boat company (TOE 55-128) is equipped with 19 LCM-8's and has the mission of supporting LOTS, fixed port, or tactical operations by transporting vehicles, containers, and heavy lifts. The cargo space of the LCM-8 is 42 feet 9 inches long and 14 feet 6 inches wide, which will permit the loading of one 40-foot or two 20-foot containers. However, normally only one 20-foot container is loaded aboard in a LOTS environment because of safety and speed considerations. (US Army photograph.)

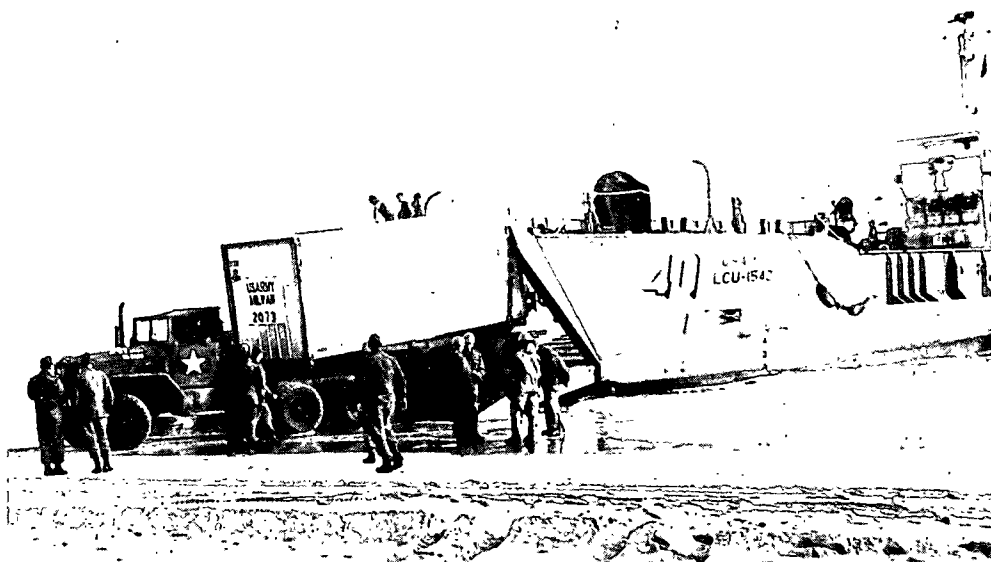


Figure 4-11. LCU. The transportation heavy boat company (TOE 55-129) is equipped with 12 landing craft, utility. The mission includes transporting vehicles, containers, heavy cargo, and personnel in ship-to-shore operations and in operations on navigable rivers, in harbors, and in inland and coastal waters. The LCU 1466 class has a cargo space 52 feet long and 29½ feet wide, providing space for four to seven 20-foot or three 40-foot containers. This wide variation in capacity hinges primarily on sea conditions—attempts to obtain maximum loads on bouncing craft may extend turnaround time to the point of inefficiency. (US Army photograph.)

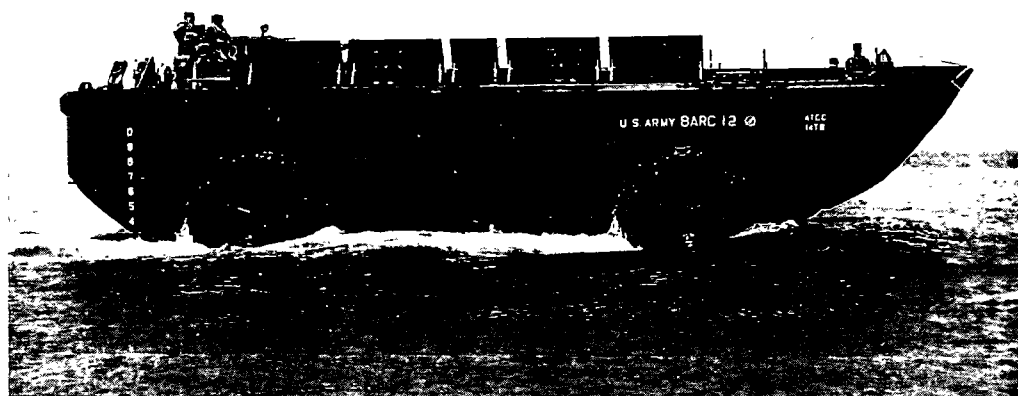


Figure 4-12. LARC-LX. The transportation heavy amphibian platoon (team FN, TOE 55-530) is equipped with four LARC-LX's and has the mission of providing lighterage for the movement of vehicles and heavy equipment during LOTS and amphibious operations. Cargo space aboard the LARC-LX measures 42 feet 6 inches long and 13 feet 8 inches wide—suitable for one 40-foot container, or two 20-footers. (US Army photograph.)

The light and medium amphibians (LARC-V and LARC-XV) authorized in TOE 55-138 and 55-139 are not normally used to transport containers: the LARC-V has inadequate capacity and, although a 20-foot container not exceeding 15 short tons can be placed aboard the LARC-XV, the resulting

center of gravity is dangerously high.

In addition to the craft assigned to the organizations discussed above, beach discharge lighters and standard barges are used by the Army for transporting containers in LOTS operations.

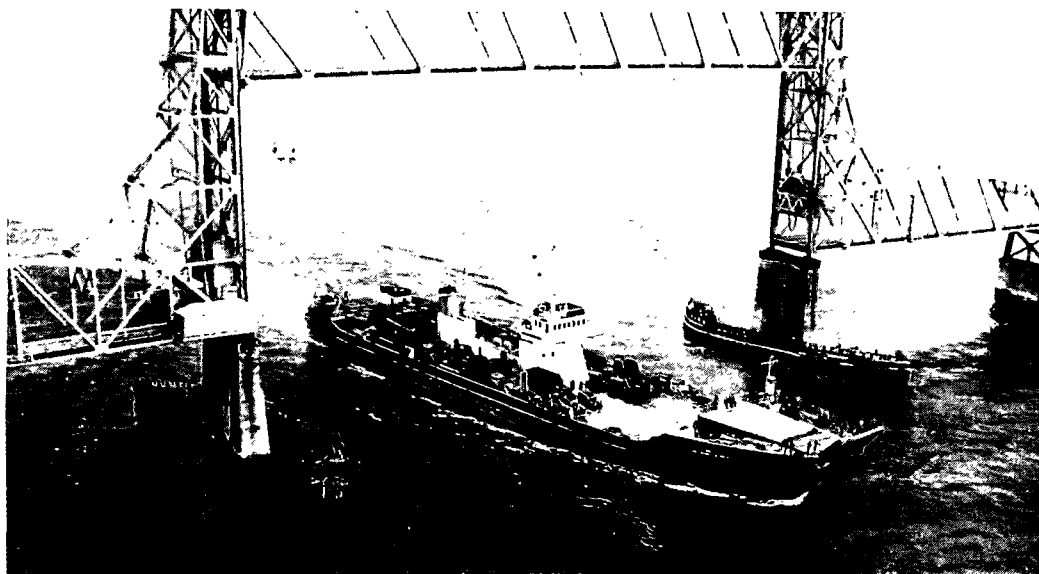


Figure 4-13. BDL. The beach discharge lighter (BDL) is a 338-foot ocean-going vessel with the capability to land RORO cargo onto undeveloped shores, either as a ferry or as a causeway from RORO vessels. The BDL has a large ramp forward and a small ramp aft, which gives it a drivethrough capability. (US Army photograph.)

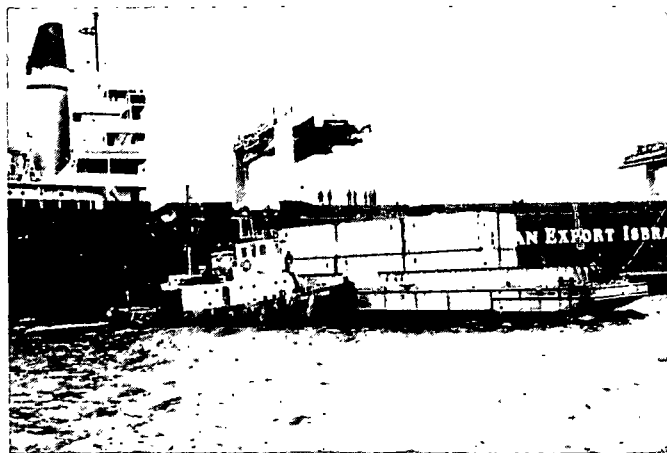


Figure 4-14. Barges. Standard barges range in length up to 120 feet, in width up to 33 feet, and in deck capacity up to 585 long tons. Containers may be moved aboard these barges in harbor, LOTS, coastal, or inland waterway traffic. This barge is carrying containers offloaded from a self-sustaining container ship and will be moved shoreward by the tug alongside. (US Army photograph.)

Use of barges in lighterage operations requires some type of pier facility at the LOTS site. Self-elevating pier barges can be used for this purpose; these are nonpropelled craft which contain jacks, caissons, and machinery for elevating themselves above the water to form cargo-working platforms. Various lengths and widths are available and may be employed in various configurations (finger, T-head, L-head) along which ships may be moored for discharge.

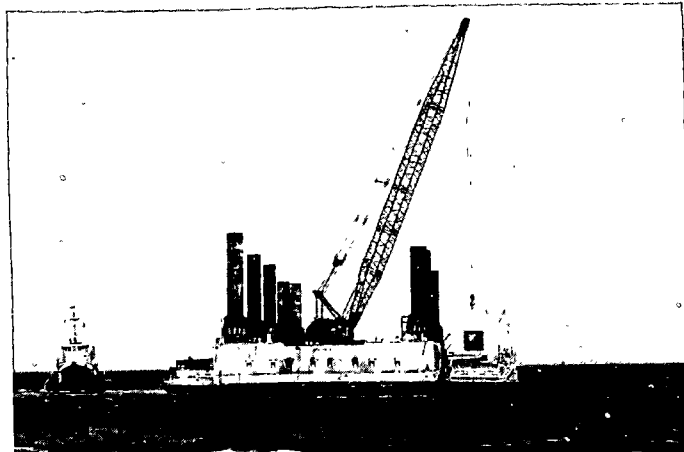


Figure 4-15. Self-elevating pier. Conventional barges must be discharged (or backloaded) at some pier facility providing protected water, sufficient depth, and cargo-lifting capability. Since the LOTS beach site rarely provides these requirements, a method of extending a barge pier facility beyond the surfline must be activated at any LOTS site as soon as possible. The DeLong type pier, developed as a submarine oil drilling platform and familiar to many transportation officers because of its use in South Vietnam, can be used to provide a suitable barge pier. To emplace, the pier is floated to the site as a barge containing caissons (piles) and jacking gear. The caissons are extended to the ocean floor and the barge is jacked up to a suitable height above the water surface. This type of facility can be emplaced beyond the beachline and connected by a floating causeway to the shore. The entire facility may be retracted and relocated. The crane shown in this picture is used to transfer containers between barge and pier. (US Army photograph.)

Inland Waterways:

Inland waterways can be used to relieve the pressure on other transport modes and are especially useful for moving a large volume of bulk supplies and heavy and outsize items. This mode may be well suited to the movement of containers in theater. Movement management considerations will determine the share of traffic nominated for movement by this mode.

4.4. Motor Transport

Motor transport, one of the principal surface modes assigned to a theater transportation system, can provide delivery from origin to destination without transfer to another mode. Motor transport has universal application for local haul, short haul, line haul, terminal clearance, and transfer operations. Almost every item entering the theater which does not terminate at the port of entry eventually moves by highway at some time before reaching its destination. There is no reason to believe that containers will be an exception.

Equipment Considerations:

From an operational standpoint, significant

shortcomings exist in our capability to transport containers with current TOE motor transport equipment. The problem stems from the physical characteristics of the containers:

- Height, 8 feet
- Width, 8 feet
- Length, 6 2/3 to 40 feet
- Gross weight, 15,000 to 67,200 pounds

These dimensions inhibit or prohibit movement on current TOE highway equipment.

Consider—

- Truck, cargo, 2 1/2- and 5-ton (rigid side), 6x6. The inside width of the cargo bed (approximately 7 1/2 feet) restricts its uses to CONEXEs or 6 2/3-foot TRICON containers not exceeding the weight limitations of the vehicle.

- Semitrailer, cargo, stake and platform, 12-ton. With side and rear boards removed, this semitrailer is capable of transporting standard 8-foot-wide containers up to 27 feet in length (without overhang) and having a gross weight up to 18 short tons. An adapter is used to secure the container.

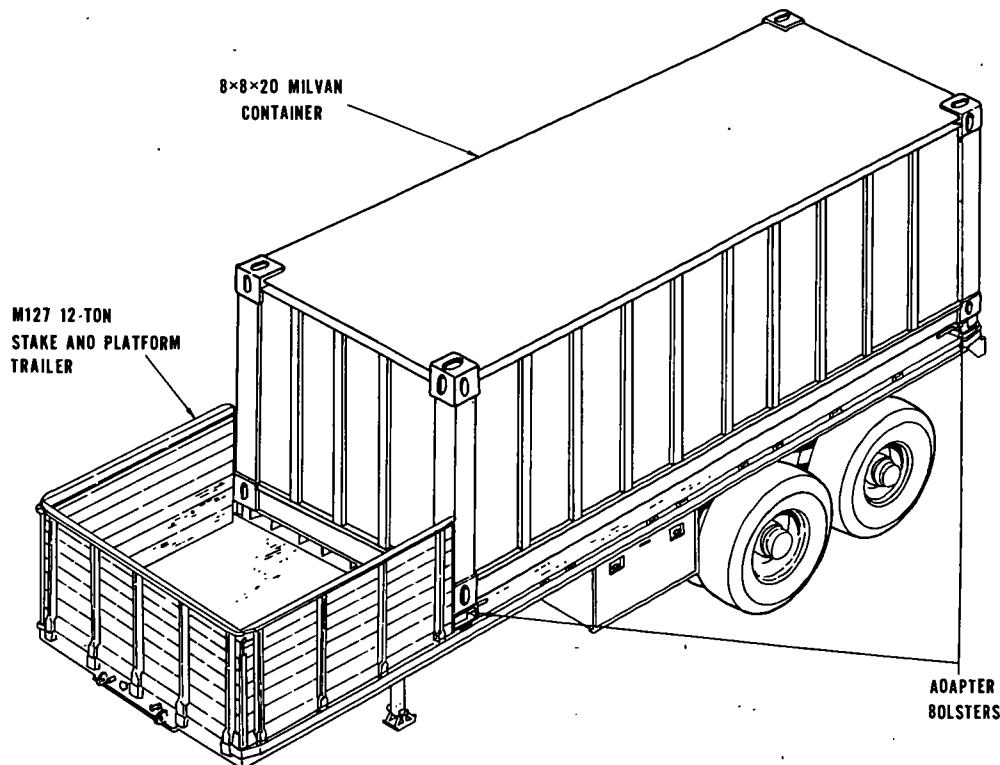


Figure 4-16. MILVAN container mounted on M127 trailer and secured by adapter bolsters. While workable, this arrangement is less than satisfactory. An 8-foot-high container with a high center of gravity mounted on this trailer creates an unstable platform, and tipovers have been experienced.

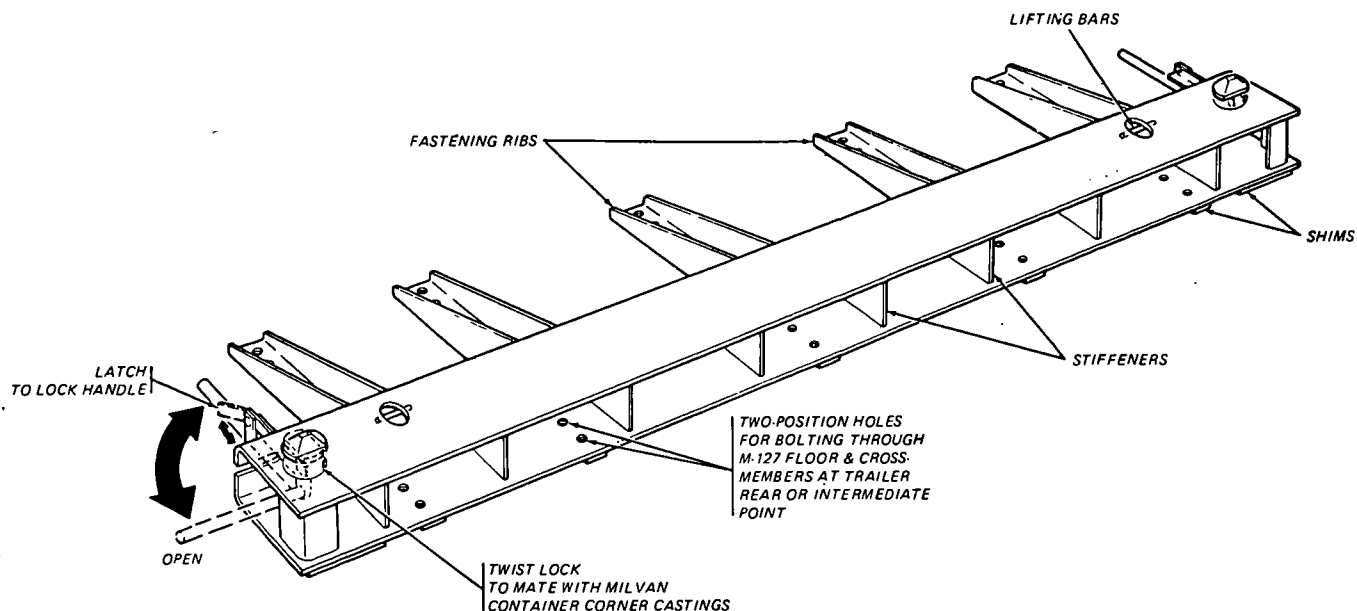


Figure 4-17. MILVAN container/M127 trailer adapter bolster. Already high, locking devices raise the deck height of the M127 even higher. Not only does stability become a consideration but, in some overseas environments, overhead clearance may create problems in routing.

- Semitrailers, low bed, 12- and 25-ton. Containers 8 feet wide and up to 9 feet high and 20 feet long (20 feet because of trailer length limitation) can be transported on the 25-ton semitrailer and up to 40 feet long on the 12-ton. The trailers have a gross weight capacity on high-

ways of up to 25 and 20 short tons, respectively. An adapter is used to secure the container. The low availability and high priority for use for their intended purpose may restrict their use as container transporters.



Figure 4-18. For containers up to 20 feet, this four-wheel, 25-short-ton commercial design low bed semitrailer provides a stable vehicle and resolves overhead clearance problems. Locally installed twist locks fit into ANSI/ISO standard corner fittings of the container. A locally fabricated van spreader bar, using a 25-pound-pull mechanical locking device, provides an expeditious and safe means of picking up the container and requires a minimum of personnel. Any crawler or truck-mounted crane with sufficient capacity for the intended load can be used to lift the container. (US Army photograph.)

- Semitrailer, tank transporter, 60-ton. This is a specialized piece of equipment not recommended for use as a container transporter. However, its

deck will accommodate standard 8-foot-wide containers not exceeding 18 feet in length—in other words, CONEXes and TRICON modules.

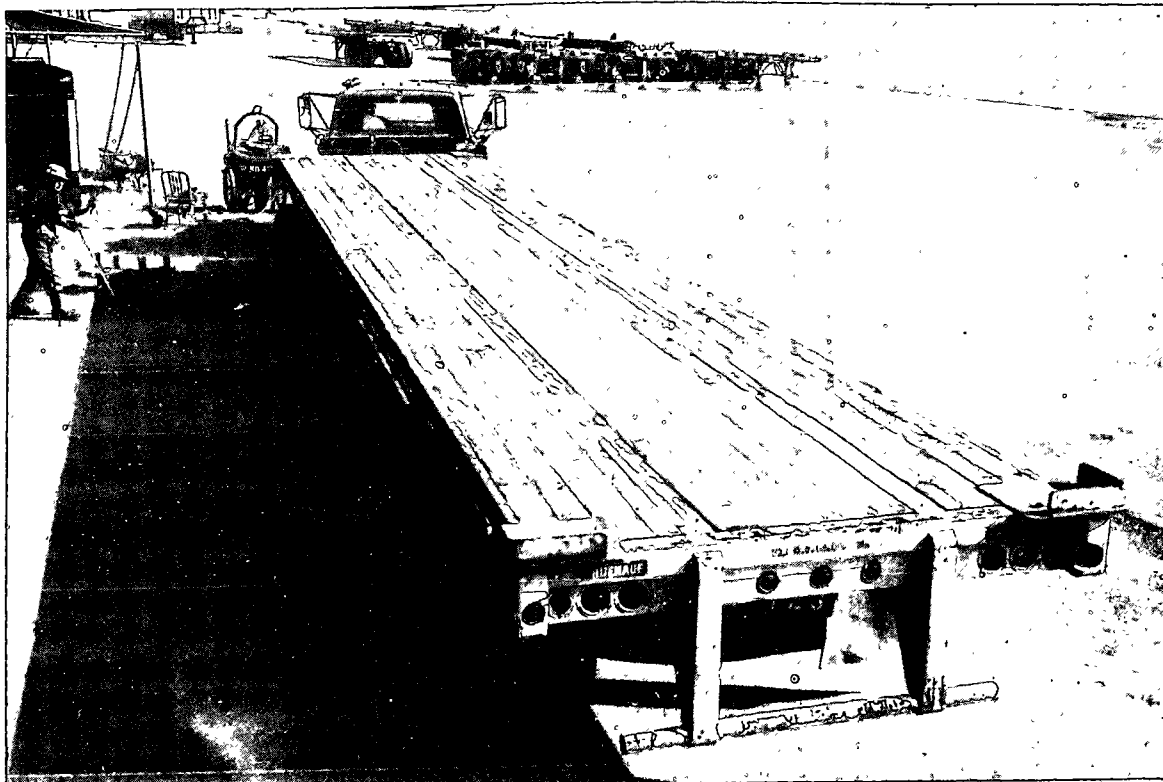


Figure 4-19. Local modifications of various types of semitrailers can be used to provide limited capability for container transport. Here a commercial platform semitrailer has been so modified to receive 40-footers. (US Army photograph.)



Figure 4-20. This semitrailer has been locally modified to carry two 20-foot containers. Note that, as with the modification shown in figure 4-19, there are no provisions for locking the container to the platform. (US Army photograph.)

• MILVAN chassis. The MILVAN chassis is not a TOE item; however, it is available on the same basis as CONEX containers to military users upon request to the Joint Container Control Office (JCCO), US Army Materiel Command Packaging, Storage, and Containerization Center (AMCPSCC). Difficulties frequently arise in mating this chassis with the currently authorized 5-ton tractors in motor transport units. Height differences between the tractor fifth wheel and the chassis fifth wheel plate cause the trailer to ride front-end-high.

Caution: Before a chassis is detached from the tractor, the landing legs must be fully extended and blocking placed on the ground so that the legs bear on it. This is necessary to prevent damage to the landing legs when the trailer drops in uncoupling.

Motor Transport Organizations:

Motor transport organizations are functionally oriented: each consists of a headquarters element, a maintenance element, and appropriate task elements to provide highway lift. There are five basic companies authorized by TOE to perform motor transport operations¹—of these, only the light-medium and the medium truck companies are considered capable of conducting effective container operations.

Transportation light truck company (TOE 55-17) NO!

Transportation light-medium truck company (TOE 55-67) YES!

Transportation medium truck company (TOE 55-18) YES!

Transportation heavy truck company (TOE 55-28) NO!

Transportation car company (TOE 55-19) NO!

The *light-medium truck company* is essentially a light truck company augmented by one medium truck squad: sixty 6x6 cargo trucks (either 2½- or 5-ton) with 1½-ton cargo trailers, plus ten 5-ton tractors with twenty 12-ton semitrailers. The 12-ton M127 trailer, whether or not modified to properly accommodate containers, is limited to an 18-short-ton load on road or a 12-short-ton load off road. Because of the high clearance and topheavy nature of this trailer when loaded with a 20-foot container, only experienced drivers should be charged with such a load.

The *medium truck company* organization, mission, and functions are basically suited to the movement of containers up to 40 feet long and up to 67,200 pounds gross weight. Certain changes, particularly to equipment authorizations, have been made to TOE 55-18. The mission has not changed but has been modified to provide for transport of dry cargo and refrigerated containers, as well as break-bulk cargo, bulk petroleum, and the 7½-ton refrigerator semitrailers.

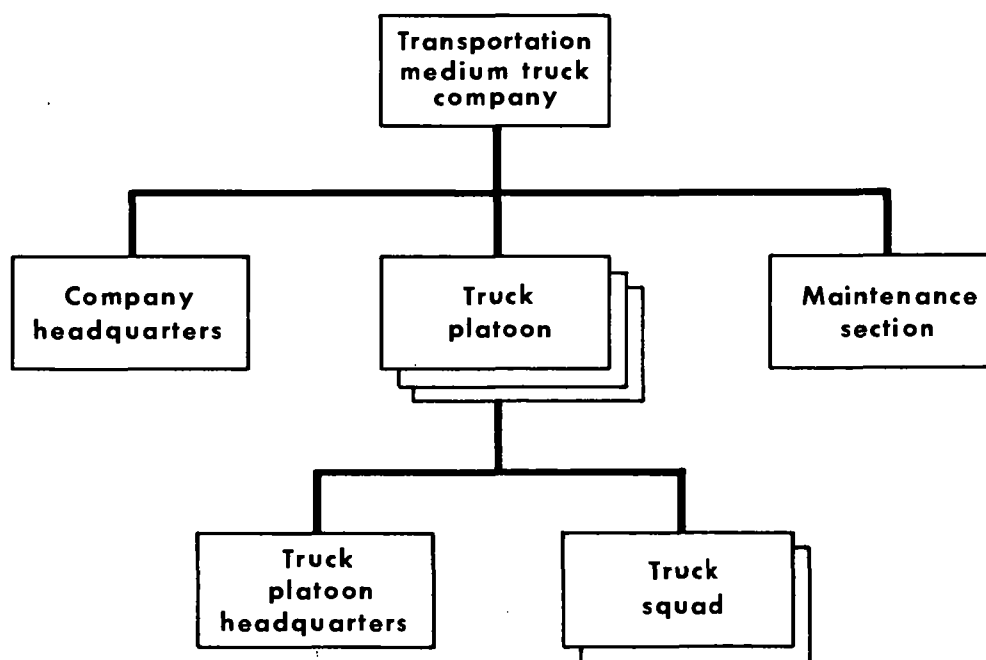


Figure 4-21. Organizational chart for the transportation medium truck company (TOE 55-18).

¹ A container capability also exists within divisions but is not considered part of the theater transportation service. A transportation motor transport company is organic to each divisional supply and transport battalion in the division support command.

The configuration of the company is flexible; it changes when the company is equipped with different task vehicles needed to accomplish a particular type of transport. For example—

- The 12-ton stake and platform cargo semitrailer currently authorized in the cargo company (variation 10) is being replaced by the 20-foot or the 40-foot dual purpose break-bulk/container transporter (chap 3). However, if operational conditions require, the 12-ton stake and platform cargo semitrailer may be issued in place of the break-bulk/container transporter.

- The military truck tractor, 5-ton, 6x6, currently authorized in the cargo company is being replaced by a commercial type 6x4 truck tractor. However, if operational conditions require a greater degree of mobility than that offered by the commercial design truck tractor, the military design may be issued in place of the commercial version.

In line haul operations the medium truck company (equipped with the break-bulk/container transporter) carries cargo from points of entry into the theater as far forward into the corps area as possible. In the corps area the company operates (as a part of the system operated by the transportation composite group or the transportation brigade) from corps rear to general support and direct support activities in the corps and division areas. This system is coordinated with the interzonal transportation elements of the communications zone and complements the motor transport capabilities of units of other corpswide services.

In local haul operations, the transportation medium truck company (equipped with the break-bulk/container transporter) is used in any type of motor transport operations where its employment is practicable and feasible. Of particular significance is its use to replace light truck companies in areas originally unsuited to use of larger vehicles, but subsequently rehabilitated or reconstructed.

With 75-percent vehicle availability (45 truck tractor and transporter combinations) and making—

two round trips per day (one per operating shift) in *line hauls*, or

four round trips per day (two per operating shift) in *local hauls*,
the medium truck company has the capabilities shown below:

Equipped with the 40-foot break-bulk/container transporter and with container loads compatible with transporter load capacity—

- In *line haul* operations, can transport 90 40-foot containers, or 180 20-foot containers, or

2,250 short tons (STON) of cargo (25 STON per transporter), or a combination thereof.

- In *local haul* operations, can transport 180 40-foot containers, or 360 20-foot containers, or 4,500 STON of cargo (25 STON per transporter), or a combination thereof.

Equipped with the 20-foot dual purpose break-bulk/container transporter—

- In *line haul* operations, can transport 90 20-foot containers, or 1,350 STON of cargo (15 STON per transporter), or a combination thereof.

- In *local haul* operations, can transport 180 20-foot containers, or 2,700 STON of cargo (15 STON per semitrailers), or a combination thereof.

Operational Concepts:

Approximately 75 percent of all cargo entering coastal ports is to be delivered directly to general support supply activities (GSSA's) located in the communications zone and corps areas. Most of this will move in military and civilian containers up to 40 feet long and having a gross weight up to 67,200 pounds. Commercial tractors hauling 68,000-pound-capacity container transporters can negotiate the relatively good road nets envisioned in this segment of the theater.

Container transport requirements forward from GSSA's—to direct support supply activities (DSSA's) and division support commands (DISCOM's)—are limited primarily to 20-foot containers (or equivalents). A military tractor possessing the operating characteristics for negotiating the difficult terrain in forward areas will normally be used to tow the dual purpose 20-foot transporter in these areas.

Interzonal container transport operations will depend heavily on the motor transport service. This will be *line haul* movement characterized by a high ratio of running time to loading and unloading time. Within broad policy established by the theater commander, the transportation command commander, as the operator of all modes, will determine whether interzonal moves will be by a combination of modes or by a single mode. Constant changes in movement control factors, enemy and friendly situations, and transport availabilities keep the transportation machine tuned to maximum productivity. Some of the considerations are—

- Capabilities of the routes to be used—overhead clearances, trailer length restrictions, weight limits.

- Feasible operating speeds.

- Length of haul.

- Personnel and vehicle assigned strengths; in other words, daily availability.

- Ratio of tractors to transporters and of transporters to containers. A ratio of at least two semitrailers per tractor is envisioned.

- Ratio of container loads to break-bulk loads.
- Specific locations of truck units, truck terminals, trailer transfer points, and terminal transfer units.
- Requirements for and availability of supporting services—marshaling area, POL, in-transit maintenance, and billets.
- Quantity of high-priority, throughput express loads.

The trailer transfer point—fulcrum of line haul: Trailer transfer points (TTP's) must be strung along the lines of communication to provide interchange services. Loaded semitrailers are shuttled forward and empty or retrograde-loaded semitrailers and containers are shuttled rearward through these points. The distance between TTP's is a key determinant of the daily movement capability of each truck company. Keep in mind that the TOE line haul criterion for medium tractors is two round trips daily. Each TTP is also crucial to the concept of inventory in motion and strict in-theater accountability for all containers, semitrailers, and transporters. The TTP can pinpoint the location of a container between origin and destination. The TTP must marshal all trailers and transporters—forward and rearward moving—so that they are dispatched the first workday after their arrival. When this becomes impossible, established priorities will rule and repositioning of tractors must be considered. Yard tractors with hydraulic fifth wheels may be employed within the TTP to assist in marshaling for movement, spotting for maintenance, inspection, etc. Consideration should be given to the use of TTP assets in recovery of disabled tractor-trailer rigs within the TTP operational area and the accomplishment of limited repairs on containers under their jurisdiction. Team GF, TOE 55-540, usually comprises a TTP. A discussion of TTP operations is contained in FM 55-30.

Intrazonal container distribution is basically a *local haul* operation, characterized by long stowing and unstowing time in relation to hauling time. Nevertheless, most of the considerations are the same as for interzonal operations—overhead, length, width, and weight restrictions; operating speeds; ratio of tractors to transporters and of transporters to containers; support services, etc. It is envisioned, however, that 20-foot containers will perform the preponderance of intrazonal resupply, with either military 5-ton or commercial 6x4 tractors furnishing motive power. Break-bulk cargo will move both on semitrailers and aboard light cargo trucks.

Local haul—where from, where to?

The great generators of local haul cargo will be—

- Ocean terminals—port clearance of all sizes of containers and break-bulk cargo consigned to nearby depots (airfields will generate a smaller amount, mostly of break-bulk cargo).
- Depots, GSSA's, DSSA's, and DISCOM's—intermediate and final distribution to requisitioners of supply items.

- Break-bulk points and consolidation and distribution points—to consignees.

Use and Control of Containers:

Although *containers are not storage boxes*, they may be essential in that role in some operational environments. They are, however, primarily transportation envelopes which must be returned quickly to loading sites if the viability of the system is to be maintained. Theater policy and contractual agreements will determine how much time using activities will be allowed for stowing and unstowing containers.

Forty-eight hours is a good starting maximum, and proximity to the front should not generally be a basis for exceeding this maximum. Rather, the receiving command must adjust manpower resources so as to accommodate the quantity and schedule of inbound containers. This will avoid not only droughts in the system but also demurrage charges, which can be significant. Violations of free time must be brought to the attention of the violator and the motor transport unit.

The responsibility for monitoring all demurrage rests with the movement control agency; the responsibility for controlling demurrage rests with the commander of each shipper/receiver. When an automated accounting system is developed, the movement control agency can easily provide daily information to the transportation command concerning violators, trends, etc., and necessary pressure can be brought to bear by the transportation command. In the case of a manual system, trailer transfer points will invariably be the first to know when free time is being violated, and the movement control agency must be informed so that necessary pressure can be applied to break loose frozen assets. Control procedures apply similarly to containers, chassis, and semitrailers and reports must—

- Record progress along the line of communication.
- Pinpoint location within prescribed cutoff periods.
- Identify status (empty, loaded, loading, unloading, en route, and in maintenance are

significant conditions affecting day-to-day planning).

Containers must be inspected for *serviceability* and *safety* and to fix responsibility for *damage*. The condition must be recorded at time of entry into theater and upon arrival and departure at each stage of each trip within the theater. Inspection forms may be locally prepared to meet local needs, but they must also *meet basic theater policy* requirements. A sample container inspection report is shown in figure 10-1. TM 55-8115-200-24 should be referenced for criteria to be applied in acceptance and inspection of MILVAN's for loading and for carrying out required repairs.

Responsibility for in-theater repair of containers is outlined in appendix D. Standard TOE equipment (for example, materials handling

equipment, transporters, chassis) are repaired under normal maintenance procedures.

4-5. Rail Transport

Commercial container movement by rail has been highly effective throughout the world. Although no active US military railroad units currently exist, maximum use is envisioned of railroads existing in any large land mass theater we enter. Where necessary, additional rail equipment and rolling stock would be introduced from CONUS, as would operating units. The entire family of containers can be moved by rail, and rail is a mass cargo mode. Huge quantities of containers can normally be moved with little interference from weather or refugee traffic. Basic rail doctrine as explained in FM 55-20 applies to container operations, and rail units require no changes to handle containers.

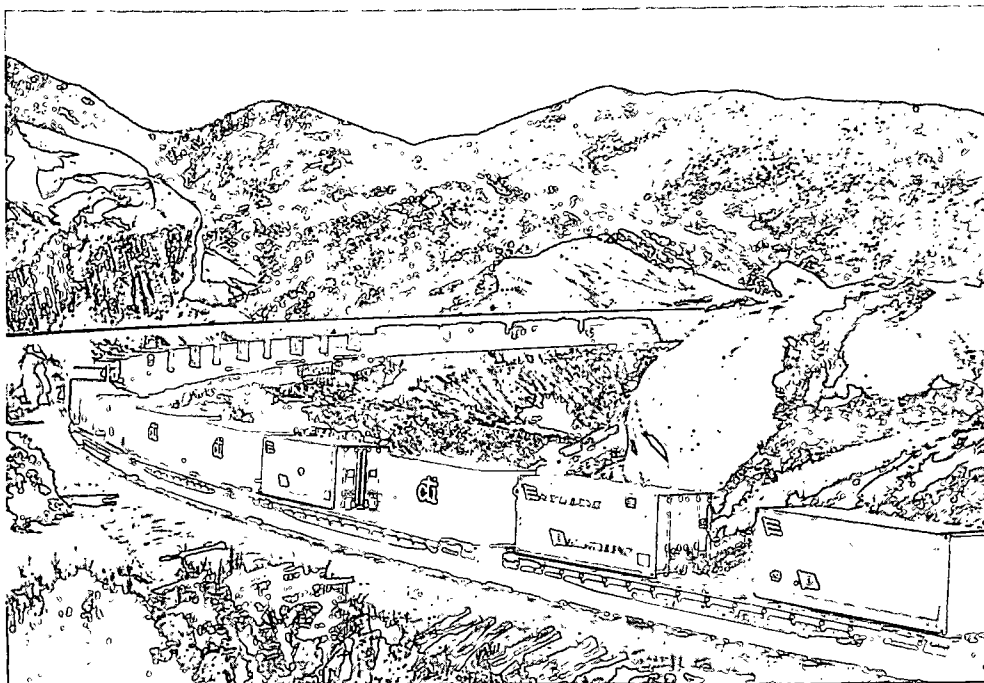


Figure 4-22. Trainload of containers moves over Cajon Pass, California. Because rail is a mass mode, maximum advantage is taken of rail nets existing in any theater to which the United States deploys major forces. The Army maintains an interchange fleet of locomotives and rolling stock in CONUS to be introduced into theaters of operation as necessary. In a long term war, American industrial capability will be called on to supplement other resources. (Picture courtesy of Union Pacific Railroad Company.)

Two basic methods exist for moving containers by rail—trailer on flatcar and container on flatcar.

◦ Trailer on flatcar (TOFC, or piggyback) is perhaps the most common. In this method the container on chassis is transported by flatcar. Because the chassis-mounted container can be towed aboard and off the flatcar, container handling equipment is not required; however, a

loading ramp is required to load the trailer onto the flatcar. A primary advantage is that at destination, the container is on chassis and immediately ready for onward highway movement. Primary disadvantages are that the chassis is unproductive during the train trip and that it is necessary to backhaul chassis to the container stowing point.

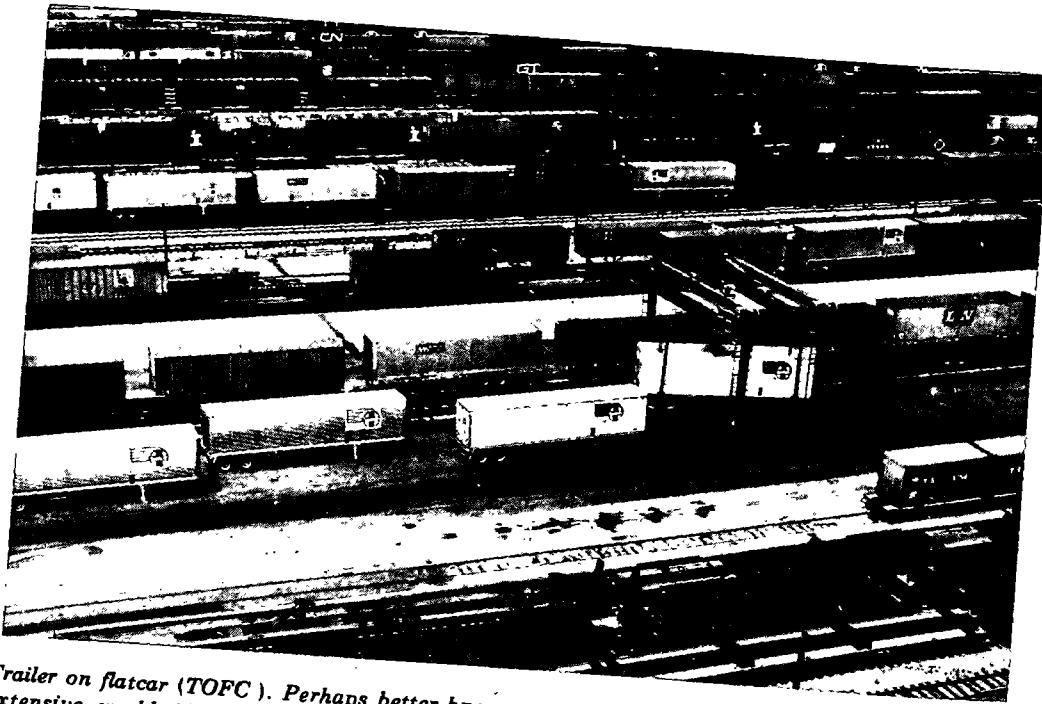


Figure 4-23. Trailer on flatcar (TOFC). Perhaps better known as piggyback, this technique of integrating rail and highway enjoys extensive worldwide commercial usage. Only limited use of this system is anticipated in a theater of operations because of the higher loads and the greater requirement for chassis inherent in this method. This picture of a large Chicago TOFC yard shows a special crane designed to speed transfer operations and widely spaced tracks necessary to accommodate the crane and truck tractors. The empty flatcars in the foreground reveal the fifth wheel supports and end-locking devices which secure trailers for movement. (Picture courtesy of Santa Fe Railway.)

Advantages of the container-on-flatcar (COFC) method include:

- Lower rail load—presenting better profiles and reducing circuitous routing.

- Reduced center of gravity—better stability, easier tiedown.
- Reduced requirement for container chassis.

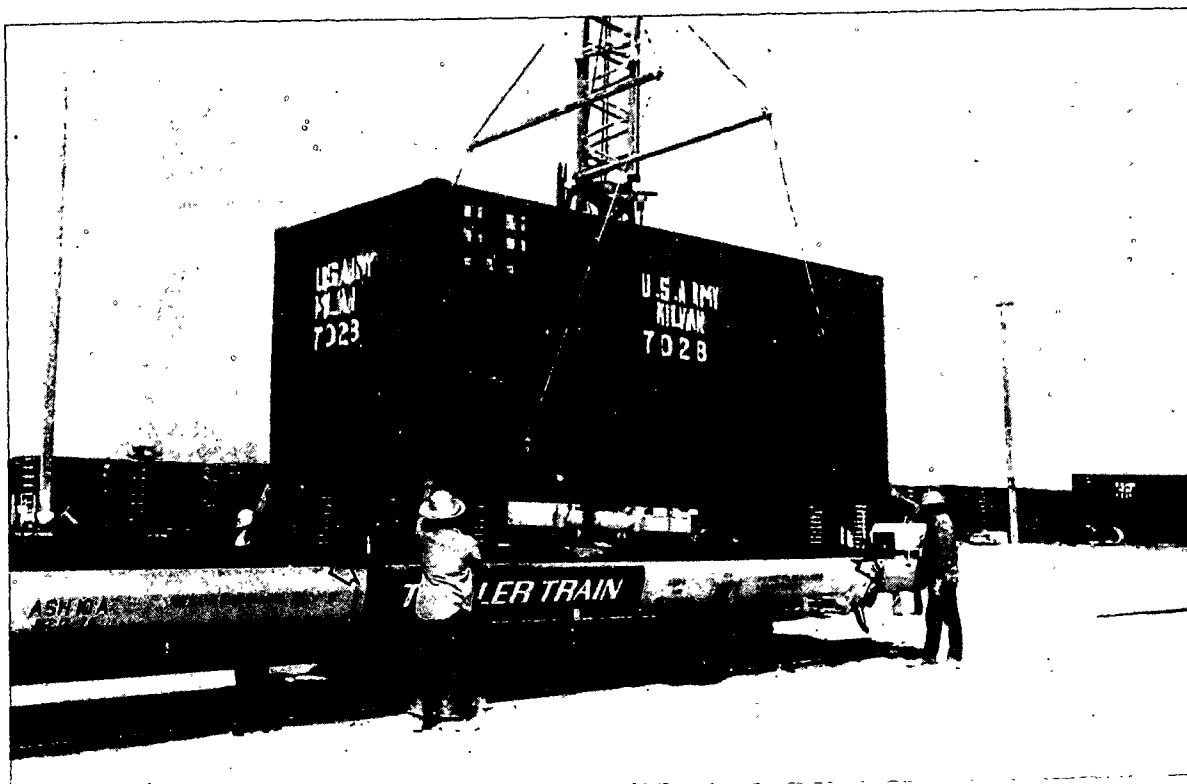


Figure 4-24. Container on flatcar (COFC). Under this system, containers are placed on railcars without a container chassis. Container-handling cranes or forklifts are required at loading and off-loading sites if this technique is used. Container locking devices are indicated by arrows. (Picture courtesy of Trailer Train Company.)

Equipment Considerations:

The policy is to make maximum use of all rail resources and personnel existing in a theater of operations. If these resources prove inadequate, the Army's fleet of foreign service engines and rolling stock will be imported to beef up the local rail resources. Domestic and foreign service cars are suitable for container movement.

It is anticipated that *commercial rolling stock* equipped to handle containers (COFC or TOFC) *will be made available* if needed. If commercial resources prove inadequate, the *Army will require fabrication of kits* to modify the foreign service railway fleet in order to have adequate locking devices on the cars. While flatcars without locking devices can accept containers, both time

and the requirement for lashing materials are reduced by using locking devices.

Within railheads, *equipment* for handling containers shipped without chassis *must be provided by the area commander*—usually this job will fall to a terminal transfer company, which is properly equipped for the mission. In the case of piggyback shipments, ramps must be provided at each railhead. A field expedient ramp can be made by removing the trucks from one end of a flatcar and lowering that end to the tracks. However, busy railheads should prepare permanent ramps, which can be used for all vehicular cargo. In rare cases, large railheads may be equipped with large cranes or lifts to offload trailers and containers from flatcars.

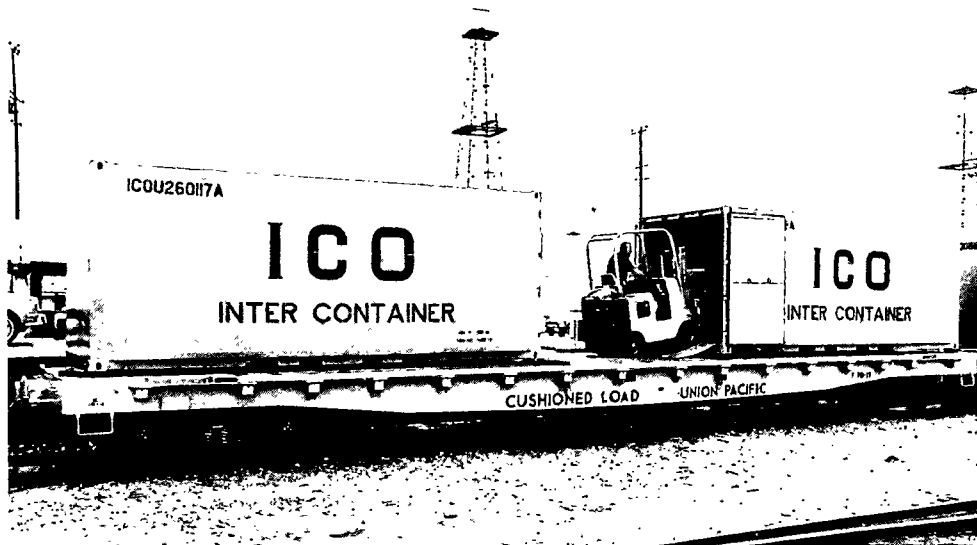


Figure 4-25. This new container handling concept developed by Union Pacific, which positions two containers aboard a flatcar with space in the center for either manual or forklift loading, permits extension of container service to areas where container handling equipment is not available. This arrangement combines the characteristics of the container and the boxcar. (Picture courtesy of Union Pacific Railroad.)

4-6. Air Transport

Introduction into the military system by the US Air Force of the C-141 and C-5A aircraft vastly increases the capability for intertheater airlift of cargo. This capability will be further increased when the freighter version of commercial jumbo type aircraft, such as the 747F, is introduced into the civil reserve air fleet. These transport aircraft can deliver cargo on a periodic basis in lots of 75

to 100 tons; in a break-bulk configuration (or even palletized) such tonnages create a very real problem for the Army, which must move the cargo from the air terminal onward to destination. Although the size of the job is relatively inconsequential when compared to the volume of cargo in seaports, railheads, or trailer transfer points, response time must be short or high priority cargo will stagnate.

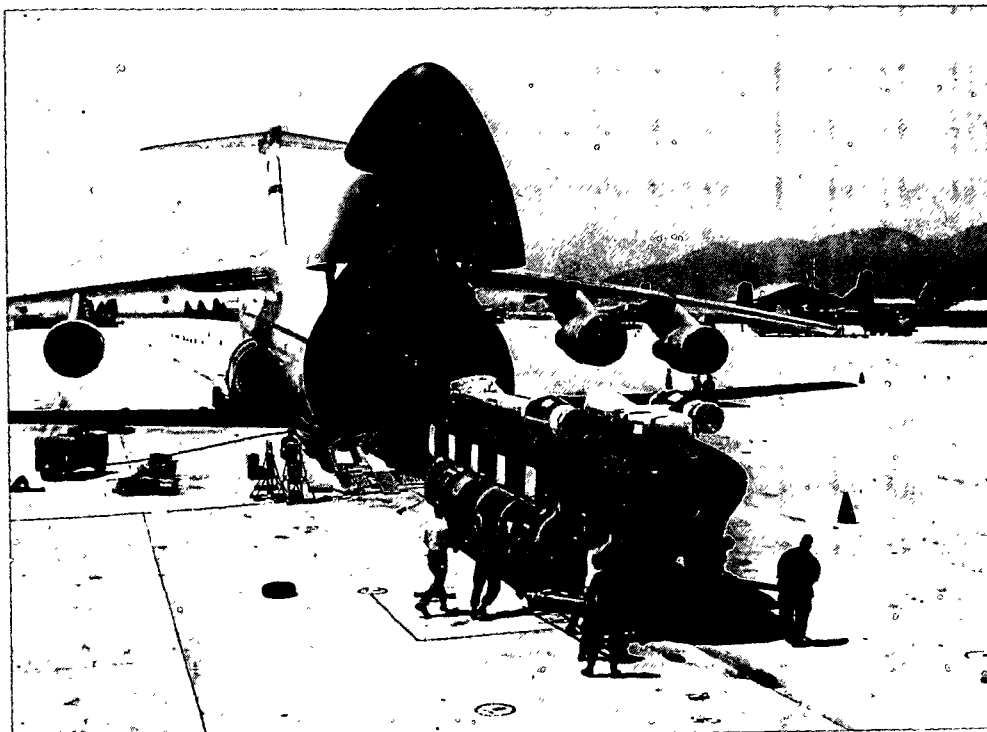


Figure 4-26. This photograph illustrates the carrying capacity of the C-5A aircraft. Three partially disassembled CH-47 helicopters as shown above may be transported at one time. (Picture courtesy of Lockheed-Georgia Company.)

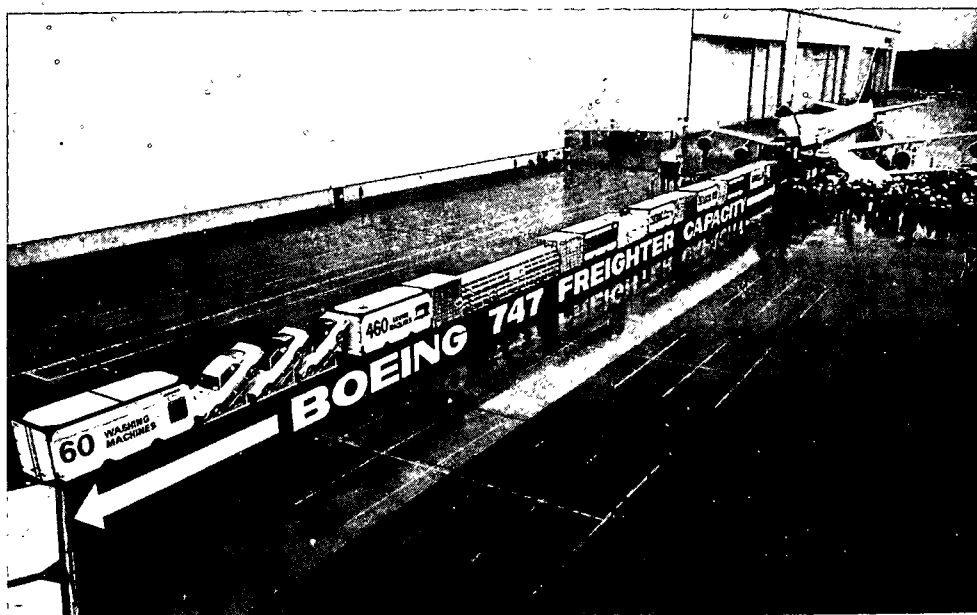


Figure 4-27. A potential load for the commercial 747F aircraft. About 5 percent of a theater's daily requirement for dry cargo in a mid-intensity war will be air cargo. Unless cargo is rapidly cleared from air terminals and delivered to consignees, the advantages of air transport are lost. (Picture courtesy of Defense Transportation Journal.)

Transport Airplanes:

The Air Force is responsible for developing doctrine and—in coordination with the Army—the equipment and operational procedures for the use of Air Force aircraft in intertheater and intratheater movement of Army cargo. At present,

there is comparatively little capability for intratheater container movement in Air Force aircraft. Container airlift will be primarily intertheater, and even this is inhibited by circumstances—

- The 8x8x20-foot (MILVAN or ANSI/ISO)

container is compatible only with C-130, C-141, C-5A, and 747F aircraft.

- The tare weight of the 8x8x20 varies from 3,200 to 4,700 pounds, imposing a relatively high tare weight penalty against the payload of an aircraft.

- ANSI/ISO standard containers do not efficiently use cargo space within aircraft. While the commercial air industry does use several Air Transport Association standard containers, neither their configuration nor their strength meet military requirements. The Air Force has been given responsibility for development of a cargo container for use with cargo aircraft. Currently the 463L pallet system is incorporated into most cargo transport aircraft. This system involves the use of slave pallets to which the cargo is restrained and which operate in conjunction with a roller rail system installed in the aircraft deck. A significant problem with this system is that the 463L pallet is not compatible with Army materials handling equipment (and some vehicles) and is not sufficiently rugged for field use.

Transport aircraft assigned to the Military Airlift Command provide *intertheater* airlift, primarily into major airfields in the communications zone.

Air Force *intratheater* airlift operates as far forward as the corps area and, if circumstances permit, even into the division support command.

Helicopter Transport:

Because of mission versatility and responsiveness of Army helicopter support, considerable reliance is placed on this mode for the lift of personnel and cargo within the theater.

Helicopter units and their assignment:

The basic operational transport units of the Army air transport service are the—

- Assault support helicopter company (TOE 1-118) (to be published)
- Assault support helicopter company (TOE 1-167)
- Assault support helicopter company (TOE 1-258)
- Heavy helicopter company (TOE 55-259)

These companies normally operate under the command and control of the aviation battalion headquarters (TOE 1-256). Within the corps, the battalion is normally assigned to the transportation composite group or the transportation brigade of the corps support command, where it may be employed in both combat support and combat service support roles. When assigned to the communications zone to fulfill a logistics role, assault support helicopter companies are normally assigned to an aviation battalion. The battalion, in turn, is assigned or attached to the transportation command, so that the unique capabilities of this mode can be effectively integrated into the theater transportation system.

Helicopters and the container—

There is a great potential for employment of heavy lift helicopters in a logistics role. Expedited movement of vehicles, equipment, and outsize items in the logistics over-the-shore mission, over lines of communication, between supply activities, and between modes at transfer points are typical examples. As containers are an increasing portion of daily cargo movements, the helicopter must be adapted to lifting containers whenever possible.

Currently no helicopter in the system can lift a fully loaded 20-foot container. However, the practicability of lifting selected containers weighing up to 10 short tons with the CH-47 and up to 12 short tons with the CH-54B Skycrane has been proven in the Offshore Discharge of Container Ship (OSDOC) exercises.² Contracts have been let with industry for development of a heavy lift helicopter (HLH) with a design lift capability of 22½ short tons which, for many missions (depending on ambient conditions), will provide the capability of lifting up to 35 tons. The HLH, when it enters the system, will be the task aircraft of the heavy helicopter company and will be employed to a large extent in a logistics role. Assignment may be to the corps support command or the transportation command. (Refer to chapter 11 for a discussion of the HLH.)

² Two of these exercises were conducted at Fort Story, Virginia: the first in December 1970 and the other in October 1972.

4-7. Summary—Transportation Modes and the Container

Containers can move by every mode, but the full advantages of containerization are not reached in most modes until some adaptation is made. In sealift, special ships make all the stevedoring functions faster and easier. In motor transport, special transporters or chassis reduce time-consuming handling. Rail perhaps requires less adaptation than the other modes, but is made more effective when special rolling stock is available.

All air container movement is significantly limited by the weight of the load and, while size and shape are not major problems in slinging a load beneath a helicopter, both size and shape do inhibit internal movement of containers in aircraft. Externally loaded containers offer a great deal of wind resistance, especially when they will not streamline. These factors must be considered in mission planning because they severely limit the helicopter's speed and range.

All the modes have a common requirement for special lifting and handling equipment—cranes, endloaders, and sideloaders are prerequisite to maximum efficiency in container operations. After receiving these refinements, containerization brings nothing but advantages to each of the modes.

Because it is cost effective, containerization will continue to be developed by commercial industry.

Military transportation will enjoy the benefits of this evolution, and must equip itself with the hardware necessary to operate those portions of each mode beyond the limits of commercial operators.

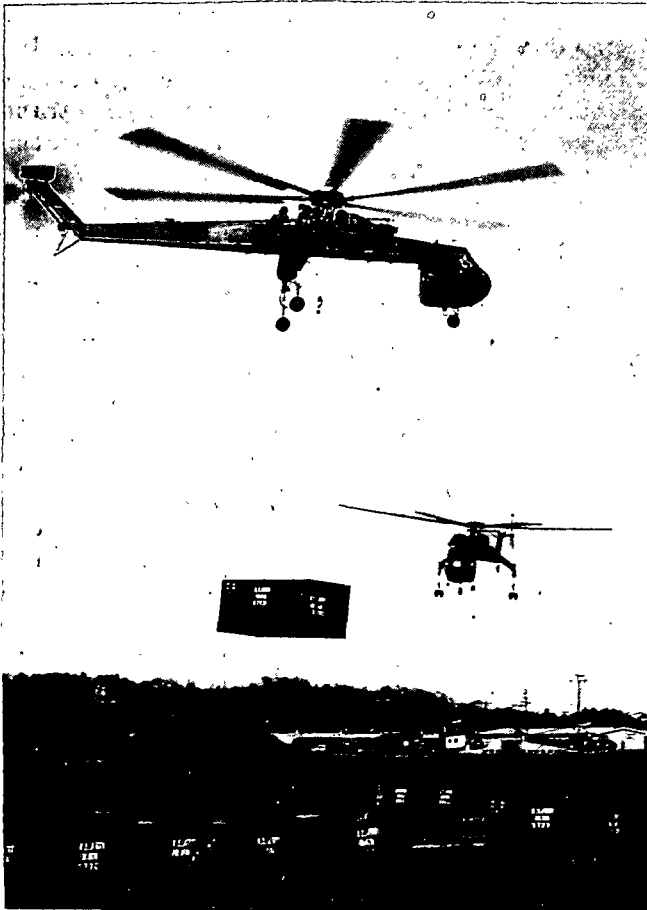


Figure 4-28. OSDOC II testing has proven the feasibility and practicability of the helicopter in container operations. Evolution of helicopter state of the art will inject even greater viability into theater resupply as the capability is attained in the next few years to move containers weighing up to 22½ short tons. Ship discharge, intermodal transfer, and express delivery of urgent items via helicopter will become commonplace.



CHAPTER 5

TERMINAL OPERATIONS

Section I. GENERAL

5-1. Types of Terminals

Terminals in the transportation system include military and commercial facilities (air and surface) used for loading, discharging, and in-transit handling of cargo and personnel through various modes of transportation.

5-2. Doctrinal Concepts

FM 55-60 sets forth current Army doctrine

concerning terminal operations. Doctrine concerning terminal operations related to Army transport helicopter operations is contained in FM 55-40. However, neither manual addresses the impact of large scale containerization upon existing procedures and equipment currently available in the Army inventory.

Section II. TERMINAL SERVICE ORGANIZATION

5-3. Current Organization

Terminal service organization as discussed in FM 55-60 provides a terminal brigade and terminal group structure that is designed to provide high-level planning of theater terminal operations for the theater army. The terminal battalion is the headquarters unit having operational responsibility. The terminal is the primary area of operation of the terminal battalion headquarters and its subordinate units.

The basic cargo operating companies in the terminal organization are the transportation terminal service company (TOE 55-117), the transportation terminal transfer company (TOE 55-118), and various teams from TOE 55-560 to include cargo handling and cargo documentation augmentations. The two terminal companies are the operating units that are involved in container operations at various terminals. Since they are designed specifically for break-bulk type operations, certain revisions have been made in their structure and equipment to provide for discharge, backloading, and in-transit handling of containers.

5-4. Transportation Terminal Service Company (Container)

The transportation terminal service company TOE 55-117G has been revised as TOE 55-117H and is published in two variations: TOE 55-117H410 for handling break-bulk cargo and TOE 55-117H420 for handling containers.

Mission:

To discharge, backload, and transship containers at water terminals located at ports or beaches.

Capabilities:

At level 1, operating on a 20-hour basis with 75-percent availability of equipment, can—

In a fixed port operation, discharge 390 containers and, at the same time, backload 390 containers; or discharge 720 containers; or backload 720 containers.

In a logistics over-the shore (LOTS) operation, discharge 300 containers or backload 300 containers.

Sort containers by destination and load containers from the marshaling yard on land transportation and perform limited stowing and unstowing of container cargo.

Account for all cargo handled as required by MILSTAMP procedures and prepare necessary transportation documentation.

Provide limited in-transit storage as required.

Assignment:

Assigned to a transportation command. Normally attached to a transportation terminal battalion or may operate separately under supervision of an appropriate commander.

Organizations:

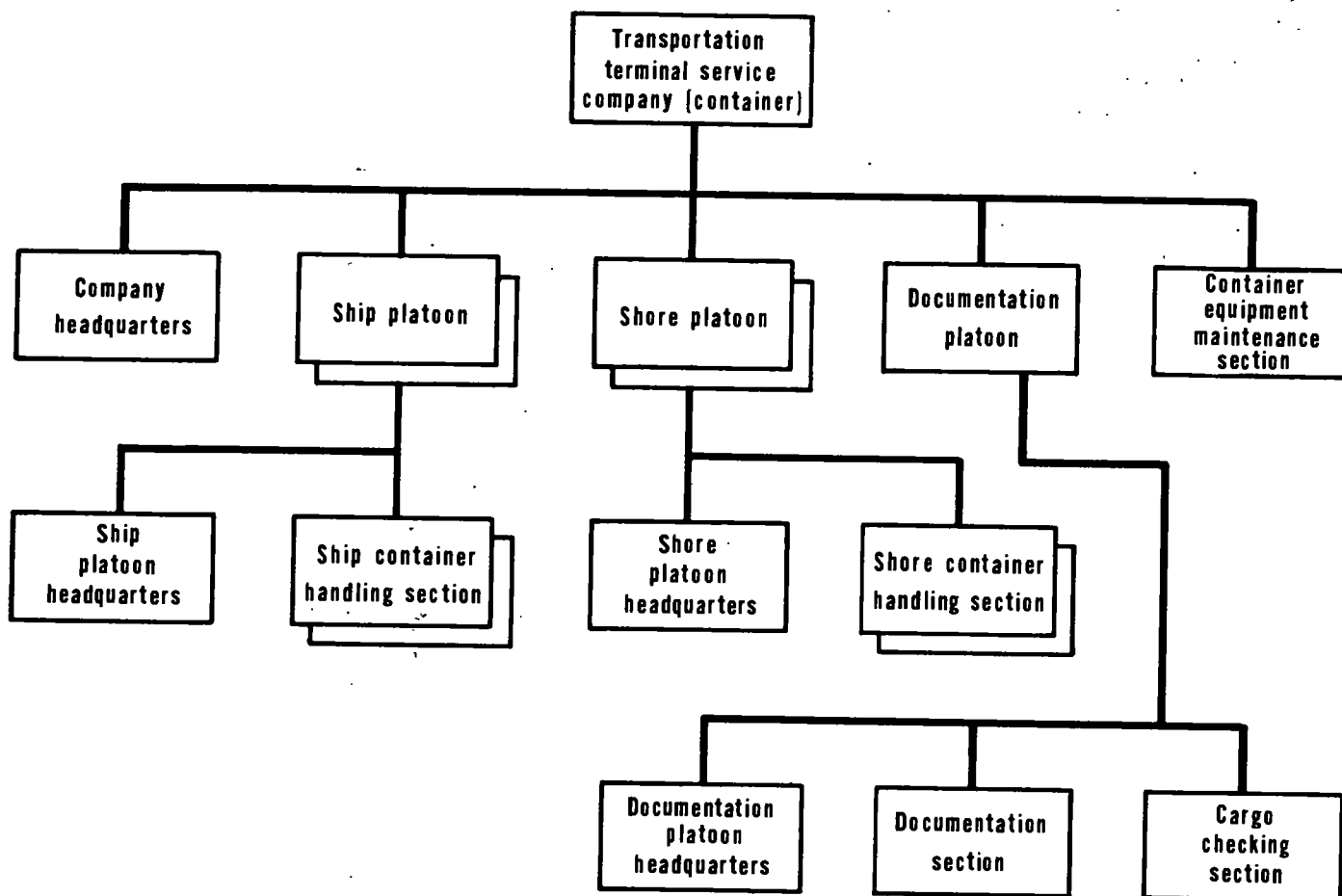


Figure 5-1. Organizational chart for transportation terminal service company (container) (TOE 55-117H420).

The company consists of two ship platoons, two shore platoons, a documentation platoon, a container equipment maintenance section, and a company headquarters.

Operations:

The company can work a completely containerized port or the containerized portion of a port that handles both break-bulk and containerized cargo. In most ports, both containerized and break-bulk cargo will be received. Cases of this nature will require both a terminal service company (container) and a terminal service company (break-bulk).

- The *ship platoons* are responsible for all ship and shipside operations. Each platoon has two ship container handling sections with one container crane per section. Although the container cranes are organic to the TOE, the preferred

method of operation is to use the cranes that are a part of the fixed port facilities. However, in a wartime operation, fixed port equipment may be unavailable or inoperable.

The ship platoon opens and closes hatches, lifts containers off the ship, and places containers on yard trailers; when backloading, the platoon performs these steps in reverse.

In LOTS operations, one ship platoon normally works the container ship offshore with two cranes, while the other ship platoon discharges lighterage at the beach with two cranes.

- The *shore platoons* are responsible for physical movement of containers from shoreside crane location to the container marshaling area, stacking of the containers, and control of the containers while they are in the marshaling area.

An additional responsibility is stowing cargo in and unstowing cargo from containers for forward movement. The shore platoon is also involved with retrograde movement of containers which, once delivered to the container marshaling area,

are under shore platoon control.

The organization of the shore platoon into two container handling sections parallels the organization of the ship platoon so that one shore section can support one ship section.

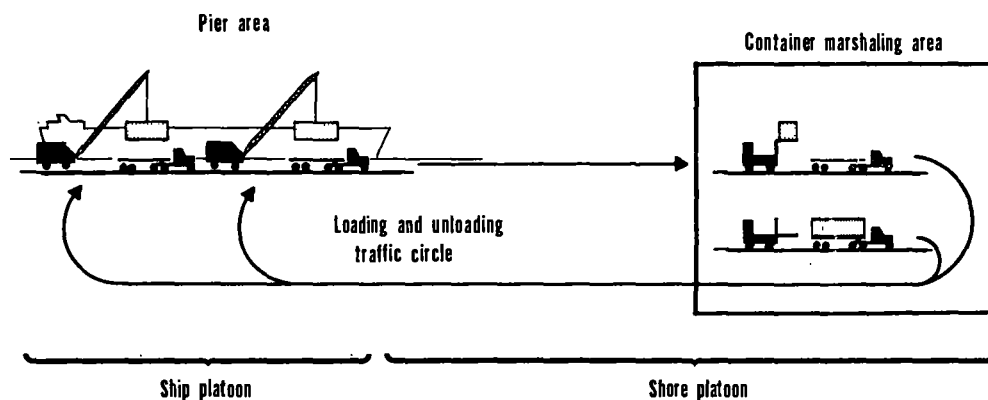


Figure 5-2. Fixed port operation. Here the company works a ship with two organic cranes. The other two cranes assigned the unit may also be employed at the ship or may be tasked to work another vessel. The shore platoons support the ship platoons by moving discharged containers from the crane site to the marshaling area. If the fixed port container handling cranes are available and operable, their use is preferred to those in the terminal service company.

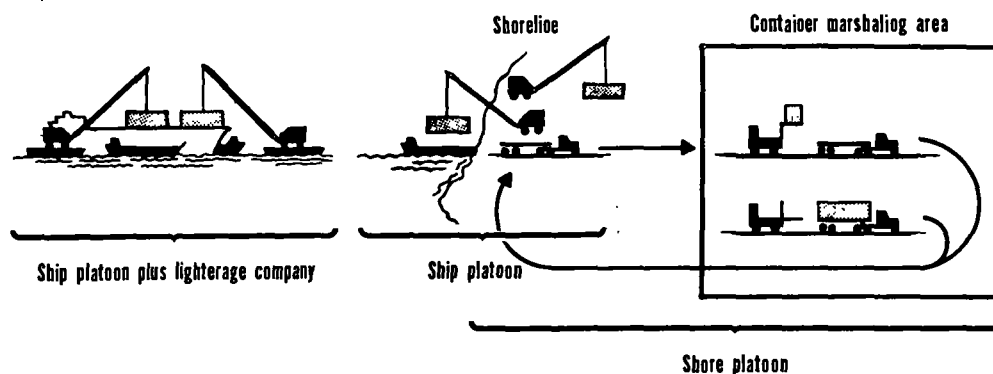


Figure 5-3. LOTS operation. In a LOTS operation, one ship platoon of the terminal service company (container) normally works the ship anchored offshore and the other ship platoon works at the water's edge, where it transfers containers from trans-hydro craft (lighterage) to shore platoon semitrailers for further movement of the containers to the marshaling area.

- The *documentation platoon* is responsible to check containers off the ship, into the container marshaling area, and into the local or line haul system and to prepare and process the necessary

documentation for onward shipment. The platoon provides the same service for the retrograde movement of containers.

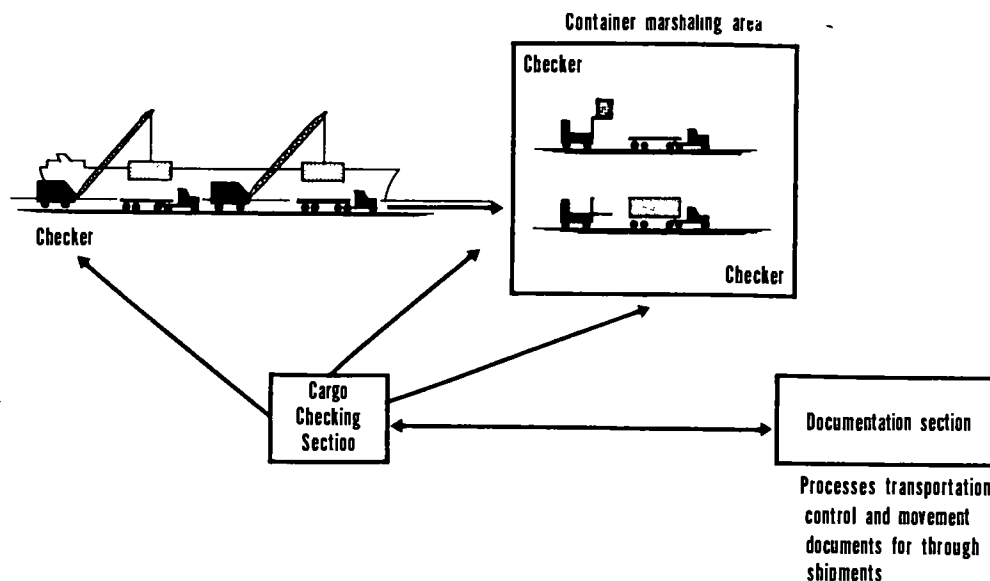


Figure 5-4. Operations of a documentation platoon at either a fixed port or a LOTS site.

• The *container equipment maintenance section* is responsible for organizational level repair of equipment organic to the terminal service company; it also provides limited emergency repair of containers as required for their further movement.

Major Items of Equipment:

Chapter 3 provides a detailed treatment of the materiel needs of a terminal service company employed in container operations. Listed below are major items of equipment, number required, and assignment within the company:

- 8 low mast forklifts, 2,500/4,000-pound-capacity (2 per shore container handling section)
- 12 container sideloaders, 2-high stacking; capable of handling containers up to 40 feet in length (3 per shore container handling section)
- 2 15,000-pound-capacity forklifts (1 per shore platoon)
- 4 mobile cranes for handling 20- to 40-foot containers (1 per ship container handling section)
- 2 mobile ramps (1 per two shore container handling sections)
- 28 yard semitrailers, 34-ton (7 per shore container handling section)
- 28 hydraulic-lift fifth-wheel yard tractors (7 per shore container handling section)

A fixed port operation requires a mobile crane capable of handling a 40-foot ANSI/ISO standard container. The crane boom length must permit the crane to reach across the container ship's deck to the outboard container cell with the crane positioned on a pier or quay and to extract a 40-foot container from the ship cell. In a LOTS

operation, the non-self-sustaining container ship may require a barge crane or similar configuration of equipment for discharge of containers.

It is expected that greater efficiency will be realized from the use in terminal operations of organic yard tractors and yard trailers to transport containers between the dock or the water's edge and the container marshaling area. Use of yard tractors and trailers is in lieu of assigning the mission to a transportation truck company.

Training Requirements:

Training requirements will be met by both formal school training and on-the-job training. The basic operational skill will be obtained through a formal course of instruction and expanded by on-the-job training. Although materials handling equipment required to handle containers is similar in many respects to that already in the inventory, the size and particular missions of the new equipment do vary. Areas where additional training will probably be needed include—

- *Container crane*—Currently, the 20-ton rough terrain crane is the largest crane on which formal instruction is given. When the mobile container-handling crane enters the inventory, a course of instruction will be required to train the operator in lifting containers and accurately spotting them in a container cell aboard a container ship; on a chassis, flatbed, or rail flatcar; and into lighters.

- *Sideloader or frontloader*—Although this type of equipment is similar to a forklift, different operating techniques are involved. Training is

¹ In a LOTS operation, the 50,000-pound-capacity frontloader is used in place of the sideloader.

required to familiarize personnel with this equipment, particularly in stacking and unstacking containers in association with all modes of transport equipment.

- *Cargo handling*—A knowledge of how containers are handled during both fixed port and LOTS operations is required. Training is required in use of the various types of container slings and spreader bars. Actual exposure to hookup and unhooking procedures must be provided. Securing containers to various transport modes is also a requirement. Additionally, the cargo handler must be trained in responsibilities related to directing crane operations in the spotting of containers.

- *Maintenance of equipment*—School training is required for personnel assigned to the container equipment maintenance section, particularly in the areas of container materials handling equipment and container maintenance and repair.

Augmentation:

The capabilities of the transportation terminal service company (container) are based on requirements of an average port in a theater of operations. Actual operating conditions encountered may require additional personnel and equipment capabilities. For such a contingency, additional teams with a container handling capability are being developed in a new TOE 55-560, Transportation Terminal Service Teams.

5-5. Transportation Terminal Transfer Company

The additional requirement of handling containers does not affect the organizational structure of the transportation terminal transfer company (TOE

55-118). However, the mission has been modified and suitable container handling equipment has been authorized to give the company the dual capability for handling containers and general cargo.

Mission:

- To transship containers and break-bulk cargo at Army air, rail, highway, and inland barge terminals.

- To transship containers and break-bulk cargo transported by Air Force aircraft, as required.

Capabilities:

At level 1, the transportation terminal transfer company can—

- Transship 600 containers, or 900 short tons of break-bulk cargo daily, or a combination of both.

- As required, redocument transshipped cargo.

- Stow/unstow container contents on a limited basis.

- Operate at three separate terminals on an around-the-clock basis, in which case each terminal can transship 200 containers or 300 short tons of break-bulk cargo per day.

Assignment:

Normally assigned to a theater army or to a corps support command (COSCOM). Normally attached to a transportation command (TRANSCOM) in the theater army or to a transportation group or brigade in the COSCOM. May be attached to a motor transport group, a terminal group, or an aviation group as required.

Organization:

The transportation terminal transfer company consists of three terminal transfer platoons, an equipment platoon, and a company headquarters. A documentation section may be attached when required.

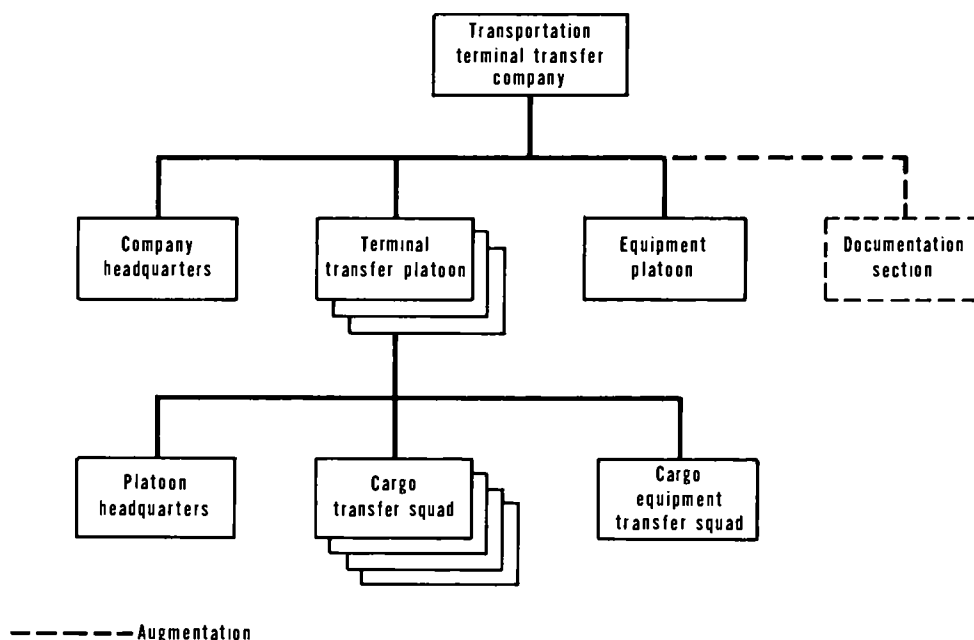


Figure 5-5. Organizational chart for the terminal transfer company (TOE 55-118).

Operations:

The company is structured so that each of its three operating platoons can work independently and may be employed simultaneously at separate terminals. For example, one platoon can be operating at an inland waterway terminal, another at an air terminal, and a third at a rail-highway terminal transfer point.

When elements of less than platoon size are needed, the required number of cargo transfer squads and necessary equipment can be detailed to other terminals or transfer points for short periods.

The terminal transfer company is not normally assigned to operate a distribution point. However, if the cargo backlog indicates a requirement, the company or its elements may be temporarily committed in support of supply units performing distribution functions, to include unstowing container contents and otherwise readying the shipment for release by the movement control activity.

Each platoon headquarters has an organic documentation capability; when this is insufficient, an augmentation documentation section is authorized. This authorization provides a unit capability to receive, hold in transit, consolidate, and transship up to 200 shipments of less-than-carload or less-than-truckload size or 50 containers of incoming and retrograde material per day on an around-the-clock basis.

Major Items of Equipment:

Chapter 3 provides a detailed treatment of the materiel needs of a terminal transfer company employed in container operations. Listed below are major types of equipment, number required, and assignment within the company:

- 6 container frontloaders, rough terrain, 50,000-pound-capacity (2 per terminal transfer platoon)
- ☆ ○ 6 forklift trucks, 10,000/15,000-pound-capacity, rough terrain (2 per terminal transfer platoon)
- 6 low mast forklift trucks, 2,500/4,000-pound-capacity (2 per terminal transfer platoon)
- 3 mobile cranes for handling 20- to 40-foot containers (1 per terminal transfer platoon)
- 3 mobile ramps (1 per terminal transfer platoon)
- 6 semitrailers, dual purpose break-bulk/container transporter, 22½-ton, tactical (2 per terminal transfer platoon)
- 6 tactical military truck tractors (2 per terminal transfer platoon)

The type of crane required must have a capability of handling 20- and 40-foot containers, normally at 25- to 35-foot reach. It will replace the 20-ton wheel crane now authorized in the company.

The 50,000-pound-capacity rough terrain front-loader is required to transfer the 20- and 40-foot container from one mode of transport to another and to

stack containers for temporary in-transit storage.

☆ The 10,000/15,000-pound-capacity rough terrain fork-lift is required to provide a container handling capability for intermediate-size containers.

Training Requirements:

School training requirements for personnel of the transportation terminal transfer company parallel those for the transportation terminal service company (para 5-4).

☆ 5-5.1. Team JB, Cargo Documentation

Team JB (TOE 55-560), cargo documentation, is assigned to the transportation command (or in a corps, to the transportation brigade/composite group) and is normally attached to a transportation terminal battalion.

The team documents cargo or containers being loaded on, unloaded from, or transferred between transportation modes. It can accomplish the documentation required in the daily handling of 500 short tons of general cargo or of 480 containers in a water terminal, a railhead, a truckhead, or an airhead.

Team JB may be used to augment the capabilities of the transportation terminal service company or the transportation terminal transfer company.

☆ 5-5.2. Team JC, Freight Consolidation and Distribution

Team JC (TOE 55-560), freight consolidation and distribution, is assigned to the transportation command (or in a corps, to the transportation brigade/composite group) and is normally attached to a transportation terminal battalion.

The team operates a consolidation and distribution point or a terminal facility that handles less-than-carload or less-than-truckload lots of cargo and/or stows and unstows containers.

Additionally, as part of its operation, the team prepares and interprets Government bills of lading, cargo manifests, transportation control and movement documents, and other documentation.

Team JC, equipped with the mobile ramp and the low mast, rough terrain forklift, is used primarily at railheads and truckheads.

The team can process 100 less-than-carload shipments daily or can stow or unstow twenty-five 20-foot container equivalents daily.

☆ 5-5.3. Team JF, Container Handling—Ship

Team JF (TOE 55-560), container handling—ship, is assigned to the transportation command (or in a corps, to the transportation brigade/composite group) and is normally attached to a transportation terminal battalion.

Equipped with truck-mounted cranes, the team is used to load and unload cargo containers at fixed

water terminals or over the beach. With 100-percent availability of equipment, and operating a 10-hour shift, the team can handle 240 containers daily (two cranes on a one-shift basis) at a fixed water terminal; or it can handle 100 containers daily on a one-shift basis at a LOTS site (using two cranes—one at shipside and one at the beach).

Team JF may be used to augment the load/unload capability of a transportation terminal service company.

★ 5-5.4. Team JG, Container Handling—Shore

Team JG (TOE 55-560), container handling—shore, is assigned to the transportation command (or in a corps, to the transportation brigade/composite

group) and is normally attached to a transportation terminal battalion.

The team is used to transship containers at a water terminal or at a container marshaling area. Operating a 10-hour shift, and equipped with the yard tractor and yard container transporter and with the 67,200-pound container-handling side-loader, it can transship 120 containers at a fixed water terminal. In a LOTS operation, using the 50,000-pound frontloader, it can transship 100 containers from the shore crane to the marshaling area. The team can operate the container marshaling area on a one-shift basis.

Team JG may be used to augment the container transship capabilities of the transportation terminal service company.

Section III. TYPES OF TERMINAL OPERATIONS IN A THEATER OF OPERATIONS

5-6. General

It can be anticipated that the following types of terminal operations will be required to support a theater of operations:

- Port terminal operations:
 - Fixed Port
 - Mobile/portable port
- LOTS operation
- Inland terminal operations serving air and surface modes

5-7. Fixed Port

Statistical data based on Vietnam experience, as well as historical data from other past engagements,

reveal that approximately 95 percent of all dry cargo is transported intertheater by ocean shipping. With the added emphasis on surface container usage, it is reasonable to believe that this percentage will continue to be valid. Although military container operations at fixed ports have been handled primarily by commercial operators, some experience has been gained by transportation terminal service companies employed at such ports in container operations.

Fixed port terminals are established shoreside installations which provide the facilities for interface between oceangoing ships and land transport equipment. They may vary in size from large deepwater complexes containing a number



of anchorage areas, piers, shore-based cranes, cargo sheds, marshaling areas, and rail sidings to small one- or two-wharf facilities with minimum provision for cargo handling, in-transit storage, and port clearance.

The introduction of the container ship—and particularly the non-self-sustaining container ship—has had a significant impact upon the physical profile of fixed ports, port operations, and materials handling equipment. At container ports, the main pier areas are dedicated to the uninterrupted flow of containers between shipside

and inland transport modes and vice versa. Container ships are usually discharged and backloaded at pierside in 24 to 48 hours as compared with 10 to 14 days for break-bulk ships. A shore-based gantry crane at a fixed port can normally operate on a 3-minute cycle to pick up a container from a ship, locate it on the dock or on a vehicle chassis, and be in position ready to pick up another container. Some container facilities estimate their capability by the hour and plan on a 20-container cycle per hour.

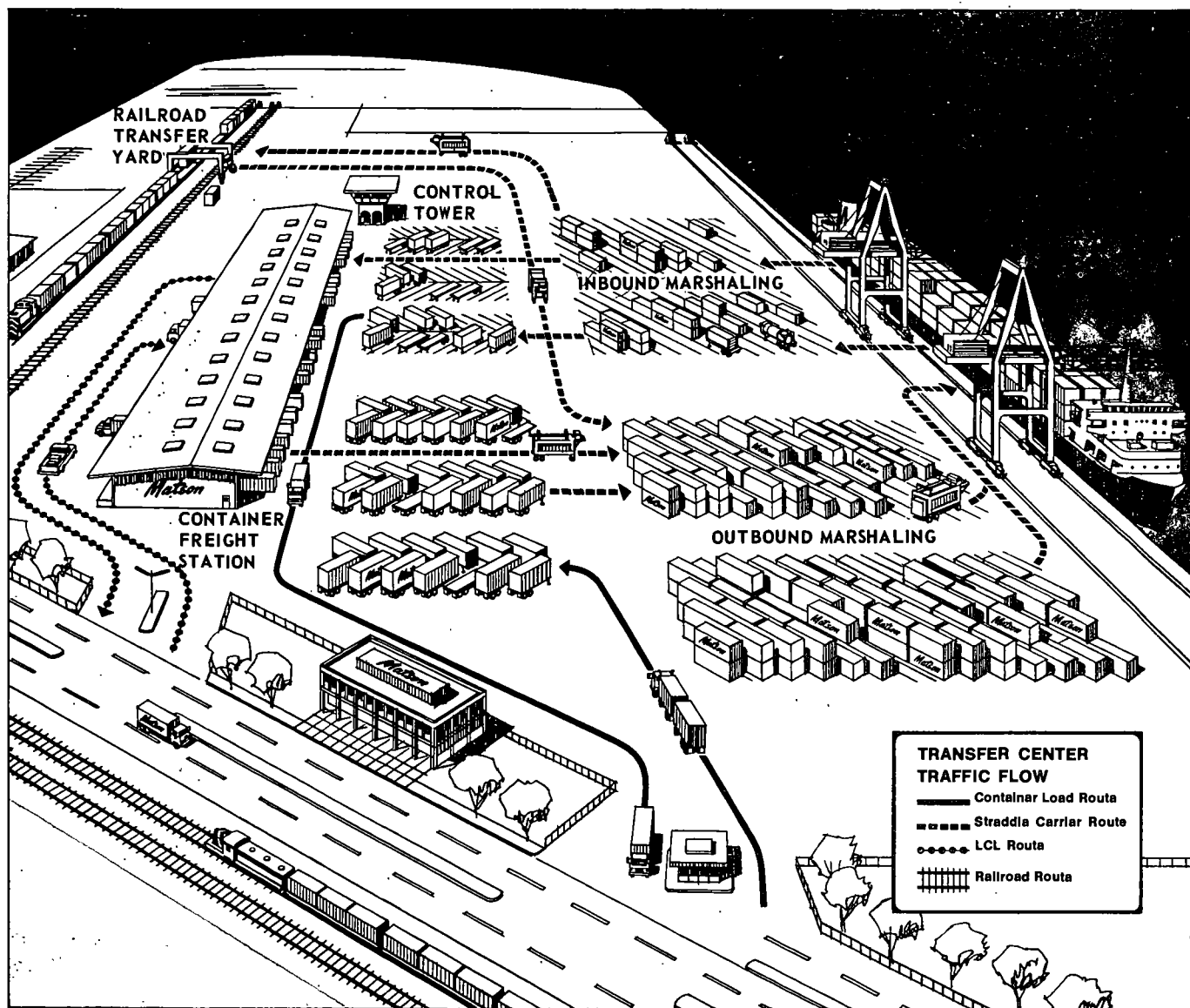


Figure 5-6. Illustrating the organization of and traffic flow through a fixed port container transfer facility. The marshaling area in a theater of operations provides essentially the same facilities. In addition to the space for temporary storage of containers, there should be space for any container repacking requirements, container repair, or other operational or administrative functions. Space requirements are influenced by type, size, and number of containers handled; length of time containers are held in the marshaling area; and container handling equipment available. (Schematic courtesy of Matson Navigation Company.)

A modern container terminal normally has access to rail and motor transportation. Adequate space is required for container marshaling areas, with room for assembling containers for loading aboard ship or for holding containers being

discharged and awaiting transport inland. Approximately 12 to 15 acres are required to marshal each 1,000 containers 20 feet in length. This space requirement is based on single-tier container units (on or off chassis) parking.

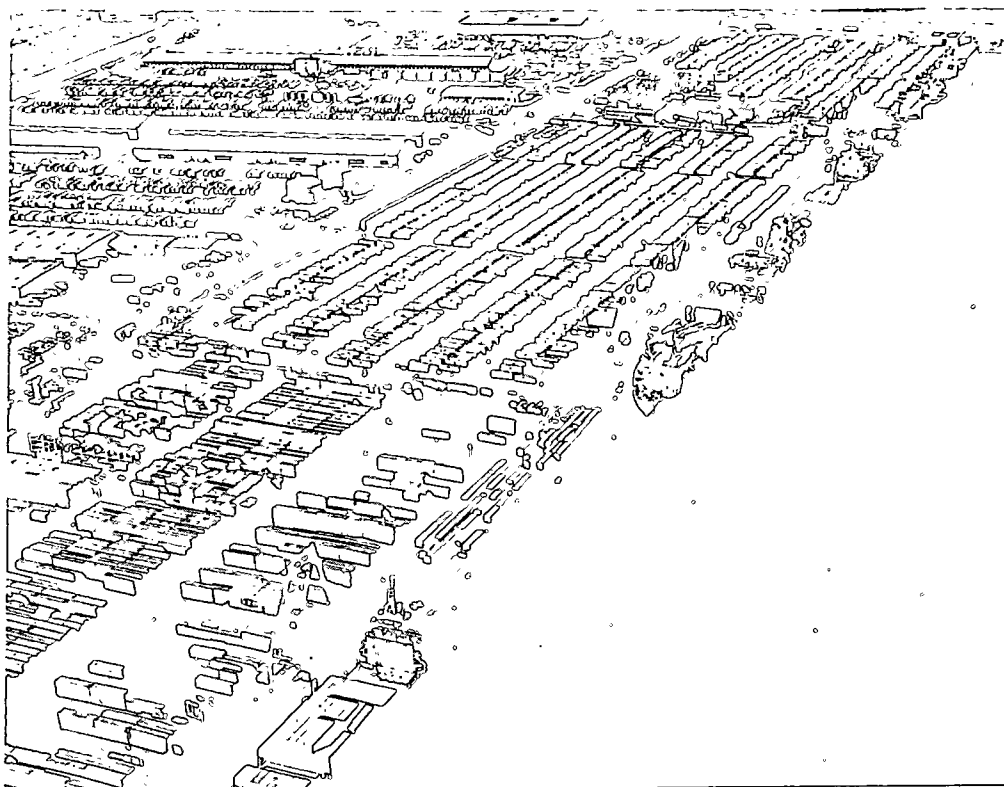


Figure 5-7. Aerial view of a modern container port. (Picture courtesy of Sea-Land Service, Incorporated.)

Some fixed ports are also equipped to handle LASH (lighter aboard ship) and SEABEE (sea barge) vessels. Here facilities are needed for staging containers and other cargo for loading into or discharging from barges, which are an integral part of these two systems. Fixed ports may also have a capability to discharge and backload roll-on/roll-off vessels, partial container ships, and multipurpose ships (para 11-9) carrying both containers and break-bulk cargo.

Commercial operators have developed a wide variety of materials handling equipment for container movement in and around port terminals. Such equipment generally falls within two categories—that required for ship-to-pier transfer and that required for operations in the terminal area.

- Ship-to-pier transfer (or the reverse) is usually accomplished by gantry cranes available either as part of the ship's gear or as permanent port facilities. Because the trend is increasingly toward the non-self-sustaining container ship, the pier-mounted gantry crane will come into in-

creasing usage. Some ports use mobile or portable truck-mounted cranes in lieu of fixed or mounted gantry cranes.

- Materials handling equipment needed after the container is removed from the ship falls generally into the category of a lifting device. The type of lifting device used is dependent upon the type of operation taking place at a specific terminal. A variety of materials handling equipment configurations are available commercially for this purpose and include such devices as overhead cranes, straddle carriers, sideloaders, front-loaders, and forklifts.

Determination of whether to stack containers or to store them on chassis in the marshaling yard is based on two factors:

- Available space
- Availability of chassis/semitrailers

Because of the large number of containers which may enter the theater, there may be insufficient trailers to permit on-chassis storage. However, if factors do permit on-chassis storage, container handling requirements are significantly reduced.

It can be anticipated that, during the early phase of a conflict, fixed port facilities will suffer damage to varying degrees and that civilian personnel who normally operate the fixed port will not be immediately available. Under these circumstances, a transportation terminal organization will assume command and control of the port, with the container terminal service company (para 5-4) functioning as the port operating element. To permit maximum utilization of the port, its facilities should be restored as rapidly as possible and, when practical, civilian personnel who normally work at the port should be placed back into port operations; however, military control and supervision normally continues for the duration of the conflict.

5-8. Mobile/Portable Port

The requirement for heavy, sophisticated handling equipment to move containers across a shoreline has led to research into pier configurations that will provide some of the advantages of a fixed port while retaining the capability of relocating operations within a reasonable period of time. *The mobile/portable port provides a means of locating the terminal facility close to where it is needed by the tactical forces, while still retaining some of the advantages of the fixed port.* The transportation terminal service company operates the mobile/portable port using the concept of operation discussed in paragraph 5-4.

The concept of a mobile/portable port is not new. The Army has had the DeLong barge in the inventory for several years and considers it a suitable nucleus for a mobile port. The Navy has developed what is known as an advance-base functional component system that contains elements of mobile ports in various sizes.

A major drawback of currently available mobile port equipment is that it is large and cumbersome, making it difficult to deploy and install. Additionally, portions of the facility are not relocatable. Finally, various configurations that have been envisioned are expensive to procure and maintain.

Designs for mobile/portable ports range from the use of fixed piers, fixed causeways, and trestles that can be used in conjunction with heavy lift helicopters, air cushion vehicles, and conventional lighterage to floating ships that are self-contained with necessary gantry cranes, materials handling equipment, and conveyer belts designed to be used as a causeway operated up to the shoreline.

A major requirement for a mobile/portable port is that it contain a crane or cranes capable of

discharging all types of container ships, including non-self-sustaining ships. The necessity for such a crane leads to a requirement for a barge, causeway, or vessel that can mount such a crane, can be moved from CONUS to a theater of operations, and can operate in open water after arrival in the theater. Such a configuration, interfaced with a causeway or a series of barges leading to the shore permits the discharging and backloading of containers between the container ship and the tractor-trailer combinations that move the containers directly inland to the marshaling area or the consignee.

Regardless of the ultimate configuration of a mobile/portable port, *its development must consider—*

- *Adaptability* of the concept and components to a wide variety of geographical and weather environments.
- *Rapidity of deployment*—the time and effort required to assemble the components in the staging area, transport them to the deployment site, and install them in a useful configuration.
- *Operational ruggedness and maintainability*—the degree to which the port components can be expected to maintain their usefulness or can be repaired without losing the beneficial use of the port.
- *Flexibility*—the ability of the port to handle various types of cargo in various types of vessels.
- *Recoverability*—the time and effort required to recover the components and place them in use again at another site.
- *Cost* of establishing, maintaining, and operating the port.
- *Manpower requirements* for installation and operation of the total ship unloading and cargo distribution system.

5-9. Logistics Over-The-Shore Operations

Logistics over-the-shore (LOTS) operations are characterized by the discharging and/or backloading of ships without fixed port facilities in friendly or nondefended territory and, in time of war, during phases of theater development in which there is no enemy opposition.

In terms of handling cargo and moving tonnage, *movement over the beach (LOTS) is the least efficient type of terminal operation.* Yet the requirement does exist to move cargo over the beach in support of military operations. LOTS operations may be required—

- *When fixed port facilities are nonexistent or, if available, are so badly damaged that they would require extensive and time consuming rehabilitation for use*
- *To supplement or increase tonnage capabilities of existing terminals*

FM 55-70

- *To relieve congested lines of communication or to reduce the land transportation required to support combat operations.*

The advantages that a LOTS operation affords over operations through a fixed port terminal derive primarily from the ability to disperse terminal facilities into small working areas (thus reducing the overall vulnerability of logistical support operations at the shoreline). However, a LOTS operation does present some significant limitations. Beach operations are hazardous when weather and/or terrain conditions are unfavorable. Adverse weather and heavy seas can cause a complete suspension of the operation. Even under ideal climatic conditions, a beach operation cannot attain the efficiency of operations at a fixed port. Beach surface is generally sand, swamp, tundra, or dirt—unimproved or, at best, temporarily surfaced. Hence, design of materials handling equipment (MHE) must provide a rough terrain capability. In comparison with fixed port MHE, LOTS MHE is limited in maneuverability and requires more maintenance.

LOTS operations are discussed in detail in chapter 6 of this manual and in FM 55-50.

5-10. Inland Terminals

Inland terminals provide cargo transfer facilities at interchange points between truck, rail, water, and air transportation nets and form connecting links between these modes when terrain and operational requirements necessitate a change in carrier.

- *Motor transport terminals* are normally located at both ends of a line haul operation, thus forming the connecting link between line haul and local pickup and delivery service to using agencies. Motor transport terminals may also be located at intermediate points along the line haul route where a change in type of carrier is required. Terminal transfer elements provide a container and cargo handling capability at the motor transport terminal and function under the operational control of the senior motor transport commander.

- *Rail terminals* may include yard tracks, repair and servicing facilities, accommodations for train crews, and railheads. They are located at originating and terminating points of trains and at sites which mark the limits of rail operating divisions. A railhead is a small yard or terminal on or at the forward end of a military railway where troops, supplies, and equipment are transferred to other modes of transportation. Terminal transfer units are employed at railheads

to transfer containers and cargo; the unit MHE is used to unload containers, vehicles, and heavy equipment from flatcars and gondolas.

- Terminal transfer units are employed at *small intermediate cargo transfer points on inland waterway systems*. Limitations on the unit's employment at these points include the size and the configuration of the marine craft and the capabilities and capacities of the unit's cargo handling equipment. When the waterway delivery means is composed largely of barges, landing craft, and similar types of floating equipment, the terminal transfer company may be employed in the trans-shipping process. However, when larger, ocean-type shipping is operated, transportation terminal service companies must be assigned for discharge and backloading.

- Air cargo transfer operations within a theater of operations take place at both *Air Force and Army air terminals*:

The Air Force commander is responsible for providing terminal facilities at all points served by the Military Airlift Command and by tactical airlift units of the Air Force component command. This responsibility includes loading and unloading the aircraft and loading and unloading Army clearance and delivery transport equipment. However, the Army commander may, by local agreement, provide personnel to participate in loading and unloading Army transportation at these facilities and may accept responsibility for loading and unloading Air Force aircraft at forward landing fields or at airstrips that are not regularly scheduled stops for tactical airlift aircraft. At those locations where the Army is charged with the mission of handling cargo, the functions are accomplished by a transportation terminal transfer company or elements of that unit.

The Army commander is responsible to coordinate and manage the flow of cargo (and personnel) to and from Air Force and Army air terminals. He carries out this responsibility through an air terminal movement control team (team LE or team LF, TOE 55-580) or, if the size of the operation does not warrant use of a team, through a transportation movement office located in the vicinity. The *terminal transfer company* is responsible for terminal operations at *Army air terminals*. This includes *loading and unloading air and surface vehicles, operating the temporary holding area, documentation, and selection and arrangement of cargo loads*. This company also handles containers that are airlifted in and out of Army air terminals.

Section IV. SUMMARY

Although doctrine concerning Army terminal operations is set forth in existing field manuals, these manuals do not treat the impact of large scale containerization upon existing procedures and equipment currently available in the Army inventory.

Because the transportation terminal service company (TOE 55-117) and the transportation terminal transfer company (TOE 55-118) are designed specifically for break-bulk type operations, certain revisions have been made in their structure and/or equipment to satisfy requirements peculiar to discharge, backloading, and in-transit handling of containers.

- TOE 55-117 (terminal service company) has been revised into two variations: one for break-bulk cargo and one for containers. The container variation (TOE 55-117H420) entails both structural changes and addition of container handling equipment capable of handling AN-SI/ISO standard containers up to 40 feet in length. The company can work—

A completely containerized port, or—

The containerized portion of a port that handles

both break-bulk and containerized cargo. The transportation terminal service company can—

In a fixed port operation, on a 20-hour operating basis, discharge 390 containers and, at the same time, backload 390 containers; or discharge 720 containers; or backload 720 containers.

In a LOTS operation, discharge 300 containers or backload 300 containers.

- Organizational structure of the transportation terminal transfer company is not affected by containerization. However, its mission has been modified and suitable container handling equipment has been authorized to give the company a dual capability for handling both containers and general cargo. The cargo handling capability has been changed from that of transshipping 900 short tons of cargo daily to—

Transshipping 900 short tons of break-bulk cargo per day, or

Transshipping 600 containers per day, or—

A combination of both of the above.



CHAPTER 6

LOGISTICS OVER-THE-SHORE OPERATIONS

6-1. General

Logistics over-the-shore (LOTS) operations are an accepted doctrinal means of injecting sustaining lifeblood into a theater of operations. Most basic techniques were developed during World War II and have been refined and updated since. Notwithstanding the many reasons why LOTS operations may be desired or required, it is irrefutable that this is a costly, relatively inefficient means of resupplying a theater.

- In LOTS, both the ships and lighterage will be required to operate in an environment which will be affected by weather and sea conditions.

- Most cargo must be handled extra times; for example, from ship to lighter, from lighter to shore.

- Specialized/additional equipment is required to offload at the beachline or above the high water mark.

- Extra time and resources are expended in the movement from shipside across the beach because of the requirement to double handle the cargo.

The same revolution which has streamlined general shipping practices holds great promise of making LOTS operations more viable and efficient than before: *containerization*. The high tempo of container operations transposed to the LOTS situation means greater tonnage ashore. One terminal service company will be able to through-put about 3,900 containerized short tons (300 containers) a day as compared with 1,000 short tons of break-bulk cargo. In a LOTS situation, these tonnages can be achieved with approximately 20-percent reduction in personnel; containerization will produce a 5:1 ton-per-man-day advantage over break-bulk operations.

A more detailed treatment of LOTS is con-

tained in FM 55-50 and FM 55-60. This chapter explains the impact of containerization on LOTS techniques.

6-2. The Extra Step: Lighterage (Trans-Hydro Craft)

Much attention has been given in recent years to the development of better and faster means of moving cargo from offshore ships across the beach. Formerly, the problem involved *small cargo drafts* (pallets, cargo nets, individual crates) and *heavy lift/outsize cargo*. With the advent of mass containerization, virtually all lifts are now outsize and probably heavy lifts (over 5 long tons). The first Offshore Discharge of Container Ship Exercise (OSDOC I) conducted at Fort Story, Virginia, in December of 1970 showed the feasibility of using helicopters to lift containers from ships and to deposit them ashore. OSDOC II conducted at Fort Story in October 1972 tested additional means of discharging containers from non-self-sustaining vessels and of getting the containers ashore.

The word lighterage, in its strictest sense, connotes floating craft which cannot transit the water's edge (barges, landing craft). However, a more liberal interpretation also now considers helicopters and amphibians as lighterage. The advantage of the amphibian and the helicopter in beach operations is well recognized: the loaded craft can cross the waterline to discharge their loads at a convenient spot. OSDOC II tested another type of *trans-hydro craft*¹ besides the helicopter and the conventional amphibian: the amphibious air cushion vehicle (ACV). The dominant characteristic of each of these lighters is its ability to transit the shoreline.

¹ The Trans-Hydro Craft Study, conducted by the US Army Transportation School in 1972, was a DA-directed study of many standard and innovative lighterage candidates. The objective was to evaluate various craft for possible adoption. Trans-hydro craft are defined as: *craft that float on the surface of the water; are supported above the surface of the water by an air cushion, foil, or other means, or fly over a body of water. They can also possess land mobility.* Trans-hydro craft are used in lighterage operations, in intracoastal and inland waterway operations, in harbor service operations, and in other roles in which mobility over bodies of water is required. In this chapter, the discussion of trans-hydro craft is generally limited to those which can transit the water's edge.

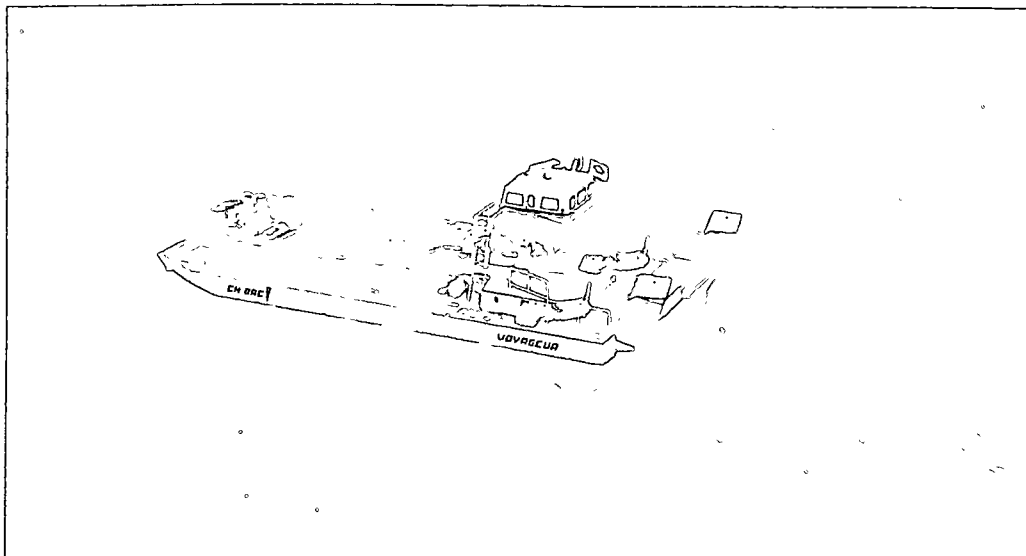


Figure 6-1. Commercial ACV. Tested in OSDOC II, this craft transported 19 short tons (16 tons in two containers and 3 tons of excess fuel) at speeds up to 30 knots in 2- to 3-foot waves with 8- to 12-knot winds and through 3- to 4-foot breaking surf. Because the ACV can transit the surfline and move the container inland to a marshaling yard without rehandling the container, the craft appears well suited for employment in a LOTS operation. (Picture courtesy of Bell Aerospace Canada, Division of Textron Canada, Ltd.)

The extra step in LOTS operations (movement to shore) incurs the penalty of added *turnaround time*. Turnaround time for conventional lighters or trans-hydro craft is comprised of these factors:

- Loading time at shipside (and at beach, if appropriate)
- Transit time from shipside to marshaling yard
- Unloading time at marshaling area (or beach, if appropriate)

◦ Delay time due to materials handling equipment/transport/breakdown/miscellaneous

◦ Transit time to ship

Obviously, reduction—or elimination—of any factor will bring LOTS operations more in line with fixed port operations. The Trans-Hydro Craft Study has selected preferred craft to accomplish this goal (table 6-1).

Table 6-1. Comparison of methods for ship-to-shore movement. Note that some steps are eliminated by the use of certain trans-hydro craft.

Work step	Barge *	Landing craft	Amphibious trans-hydro craft			Causeway ferry *
			Conventional amphibians	ACV	Helicopter	
Load at shipside	X	X	X	X	X	X
Move to beach	X	X	X	X	X	X
Unload at beach	X	X	Omit	Omit	Omit	Roll-off
Load onto transport for movement to marshaling yard	X	X	Omit	Omit	Omit	Omit
Move to marshaling yard	X	X	X	X	X	X
Unload in marshaling yard	X	X	X	X	X	X

* Barges and the causeway ferry were not evaluated as lighters in the Trans-Hydro Craft Study. Barges were tested in OSDOC II but not recommended as container discharge lighters in a LOTS operation because they are ineffective unless used in conjunction with some type of platform similar to the jacked-up DeLong pier. However, considering only average MILVAN discharge time as the measure of effectiveness, BC barges were the most productive lighters tested during OSDOC II.

During OSDOC II, several lighterage systems were tested. The results, coupled with results

from OSDOC I, indicate that the following lighterage can perform effectively in a LOTS

container environment (listed in order of priority):²

Conventional amphibians (to container marshaling area):

LARC-LX (1 40-foot or 2 20-foot containers)³

LARC-XV (1 20-foot container)⁴

Landing craft (to beach):

Causeway ferry system (6 20-foot containers)⁵

LCU 1646 class (5 20-foot containers)⁶

LCU 1646 class (4 20-foot containers)⁶

LCM-8 (1 20-foot container)⁷

Barges (to semifixed pier only):

BC barge (12 20-foot containers)

Helicopters (to container marshaling area):

CH-54B (12 short tons)

CH-47C (10 short tons)

CH-53—Marine Corps helicopter (8 short tons)

Air cushion vehicles:

Voyageur (2 20-foot containers)⁸

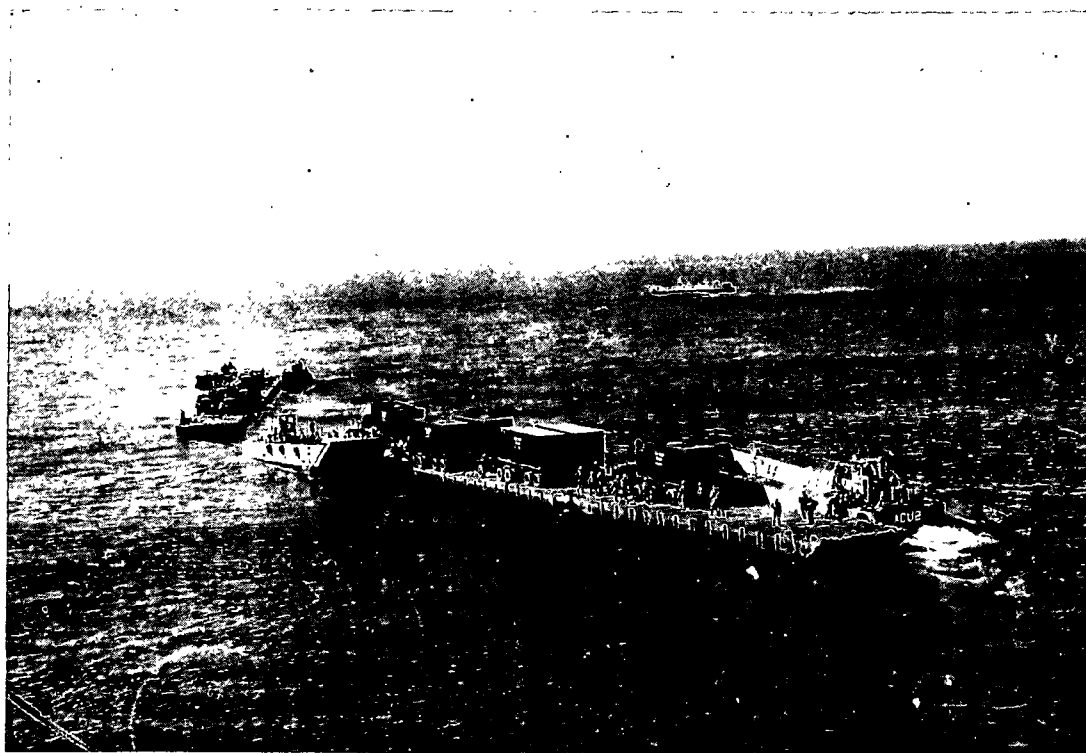


Figure 6-2. Ferry causeway. This system has been successfully used in both the Atlantic and Pacific Oceans in surf up to 6 feet. Each ferry is a 21x90-foot ponton with an end ramp across which trucks move at the beach. A ferry carrying six tractors pulling empty container transporters is being towed to shipside where it will be moved in to a working platform as shown in figure 6-7. Each tractor-transporter will move across the working platform and under a crane which will load a container onto the transporter. The tractor-transporter will then move to an empty ferry on the opposite end of the working platform. After six tractor-transporters are parked on this second ferry, it will be towed ashore where the trailers will be rolled off and the ferry will be reloaded with empties. (US Army photograph.)

² OSDOC data provide no basis for determining an order of priority for lighterage. The priorities shown here are based on the container-carrying capability and average transit times of the principal transporters within the systems addressed.

³ The LARC-LX has sufficient length for a 40-foot container and sufficient width clearance to make loading much faster than is possible with the LARC-XV.

⁴ Tested in OSDOC I, the LARC-XV is inferior to the LARC-LX because of its tight cargo space, gross weight limitation of 15 tons, and high center of gravity when loaded with a heavy container. The LARC-XV is not a preferred craft in the Trans-Hydro Craft Study.

⁵ OSDOC II testing of the causeway system was with 20-foot MILVAN containers mounted on M127 semitrailers hooked to M52 tractors. Each ferry has a weight capacity of 108 short tons while maintaining a 1½-foot freeboard.

⁶ The LCU capacity is in 20-foot containers, provided the vessel gross cargo weight of approximately 150 short tons is not exceeded. Particular circumstances may recommend a reduction; for example, any time the ship offload cycle time can be increased significantly by decreasing the lighter load, this should be done. Critical time can be lost trying to fill a lighter to maximum capacity in turbulent seas.

⁷ Two 20-foot containers will fit into the LCM-8 but, for ease of loading, normally only one will be carried except in calm seas.

⁸ Payload capacity demonstrated to be approximately 19 short tons (16 tons c. cargo plus 3 tons of excess fuel).



Figure 6-3. US Army CH-54 helicopter prepares to extract container from a container cell during OSDOC II. This is a tricky business, calling for skilled piloting. Helicopters offer fast movement of cargo directly to the container marshaling yard, or even directly to the consignee or into the line of communication should the cargo have sufficient priority. Disadvantages are the high cost of operation and the current inability to lift fully loaded containers. (US Army photograph.)

Both OSDOC exercises proved the effectiveness of moving containers via helicopter from the decks of container ships (during daylight hours) direct to the container marshaling area. The great speed with which this is done, bypassing the beach, is tempered by the high cost of the technique in aircraft, support equipment and skills, and fuel consumption. These factors account for the helicopters' low relative placement above.

OSDOC II also demonstrated the effectiveness of a commercial ACV as a lighter. The ACV reduces transit time and maneuvers well under the discharge crane but—like the helicopter—at a relatively high cost.

Dozens of variables exist between the systems available and the conditions under which a particular LOTS operation will be conducted. Weather, air superiority, proximity to the war front, priority of cargo, and many other factors interact to dictate which systems will be employed in a given LOTS operation. The transportation command commander will allocate equipment to best fulfill his responsibility to operate the entire Army transportation system within the theater.

6-3. The Setup: Organizing the Site

The *principles of dispersion* discussed in FM 55-50 apply identically whether containers or break-bulk cargo are to be worked. They bear repeating:

- At least 1 nautical mile between ships and major facilities ashore
- No more than two ships per site—this will require two terminal service companies for round-the-clock operations
- At least 5 nautical miles between separate LOTS sites

Besides dispersion, *additional principles* apply to LOTS operations:

- Clear the beach—establish container marshaling areas within 5 miles of beach.
- Establish LOTS sites near a good road or rail link to the line of communication (LOC).
- Establish a semifixed pier, causeway, etc., as soon as possible, contingent, of course, upon how long the site will be required, what trans-hydrocraft are available, and the degree of effectiveness that can be obtained with a pier. In most LOTS situations, barges cannot get close enough to shore to be unloaded. Thus the desirable barge

characteristics of large cargo capacity and uncluttered deck space (fast working) are denied

until some form of pier (floating or other) is pushed beyond the breaker line.

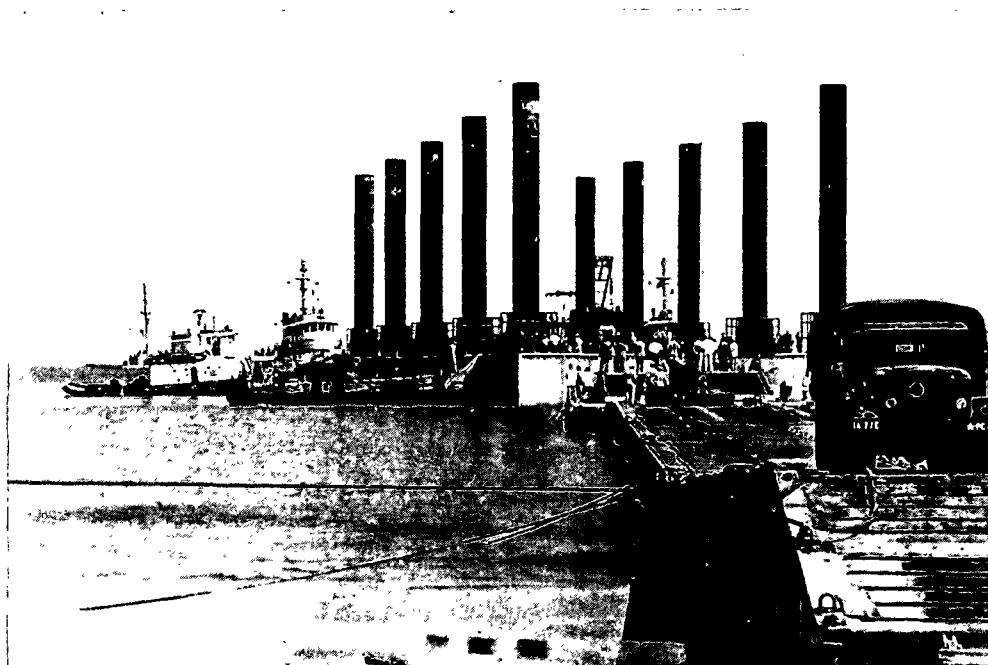


Figure 6-4. Semipermanent pier. As soon as possible in a LOTS operation, conventional facilities must be developed. This jacked-up DeLong pier is joined to the beach by a floating causeway. If water depth is sufficient and a causeway is available, ships can moor directly to the pier. Otherwise barges can be shuttled to the pier for efficient offloading. Once a pier is established beyond the surfline, conventional barges can be offloaded at that point and the containers transported to the marshaling area. (US Army photograph.)

- Avoid conflicting traffic patterns within the site.
- Optimum vessel mooring is up to 2 nautical miles offshore.
- Shore must be secure.

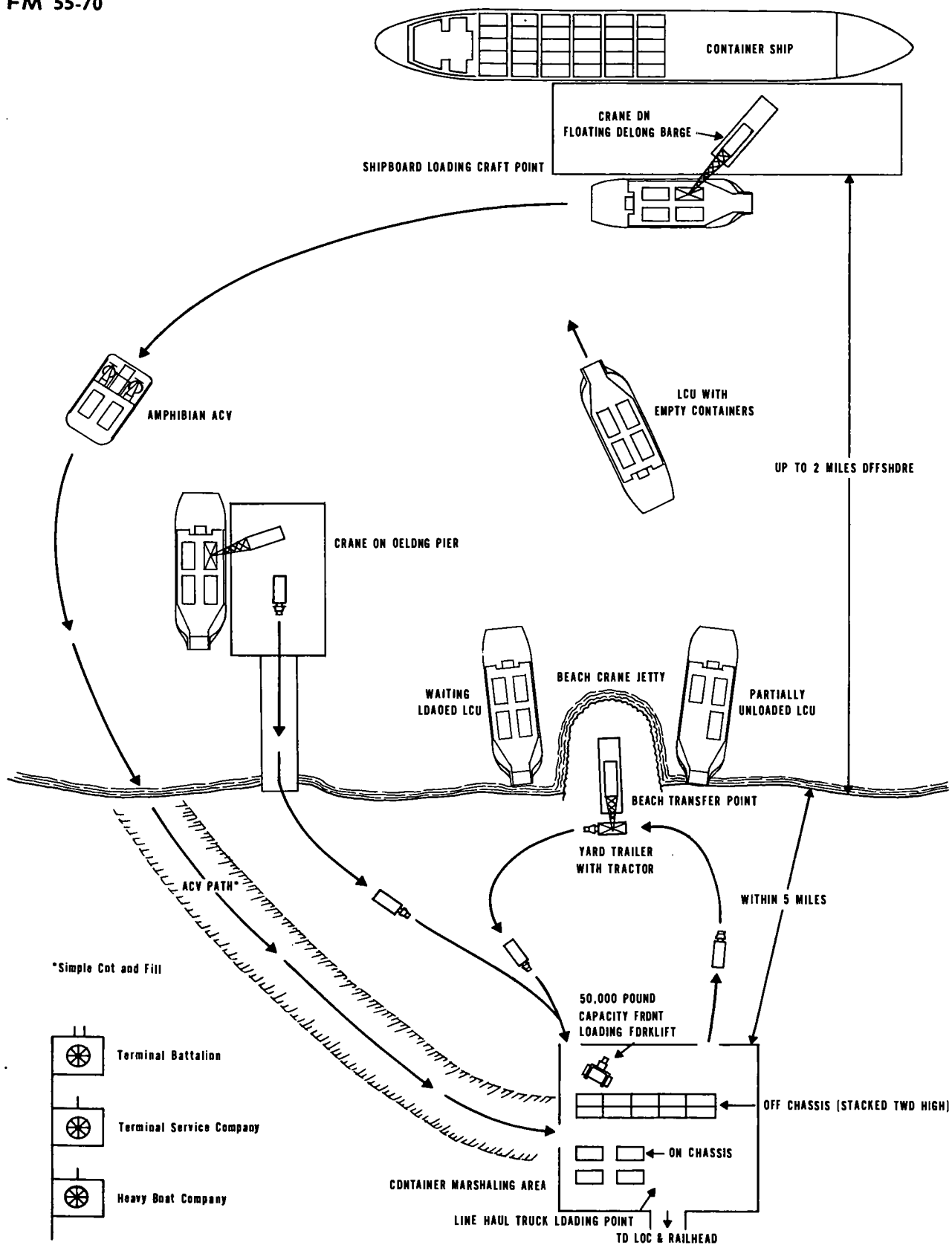


Figure 6-5. Illustrating setup for a LOTS operation. For working a single ship, more than two lighterage systems are usually unsupportable at shipside and inefficient at shoreside.

6-4. Deployment of Assets

Proper management of theater assets will be a

critical job of the theater transportation headquarters. Should a particular LOTS site be

allocated only landing craft or only amphibious craft, or would a mix be better? Assuming availability, the decision must be based upon—

- Priority of cargo
- Physical characteristics of respective sites (water depth, beach gradient, area for container marshaling yard, line of communication links)
- Flexibility (variables such as weather must not halt operations unnecessarily; for this reason, a mix of craft is usually advisable)
- Performance characteristics of available lighterage (trans-hydro craft)

Also, for non-self-sustaining container ships, critical decisions must be made regarding the use of a container discharge facility. OSDOC II experience reflects several solutions to this problem using existing equipment, pending development of a facility designed specifically for this mission. The theater decision must be coordinated fully with CONUS activities, and consideration must be given to—

- Availability of equipment
- Time and duration of operation
- Operator skills

6-5. Vessel Discharge

Just as with conventional ships, *container ships are either self-sustaining* (equipped with cargo working gear required to offload their cargo) or *not self-sustaining*. The military must depend upon the commercial fleet to deliver its containers to overseas theaters. Even in the LOTS situation, we prefer to work self-sustaining ships and every effort should be made to schedule such ships to LOTS sites. Unfortunately for military operations, however, the trend in commercial shipping is toward *non-self-sustaining* container ships. Primary reasons for this are to eliminate duplicate equipment costs (major ports are equipped with efficient shore cranes) and to increase vessel payloads. Serious impact occurs in the LOTS environment: *the military must devise, structure for, and equip itself with the means to offload non-self-sustaining container ships*. OSDOC II successfully tested several possibilities:

- Mobile crane positioned on board the container ship in such a way that hatch covers can be lifted and containers can be extracted and set onto trans-hydro craft (the crane must be set aboard at origin or at a port of call before arrival at the LOTS site)

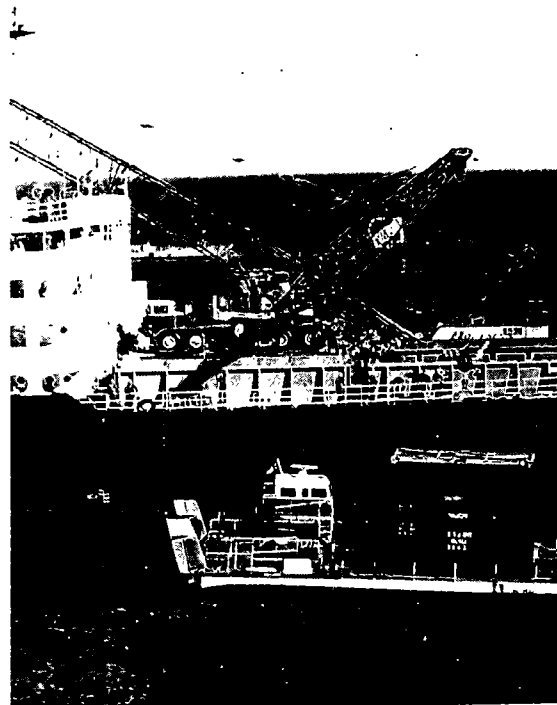


Figure 6-6. Mobile crane aboard container ship. Since the industry trend is toward non-self-sustaining container ships, the Army must provide for offloading containers in a LOTS operation. An effective solution was found to be a commercial mobile crane mounted on the deck of the ship (note that the deck and hatches must be reinforced and bridged to permit spotting the crane). The crane is placing a container aboard an ACV. The crane must be placed aboard before the ship's arrival at the LOTS site. The boom in the background belongs to a larger mobile crane on a barge moored to the port side of the container ship. (US Army photograph.)

- Mobile crane positioned aboard floating DeLong pier alongside container ship

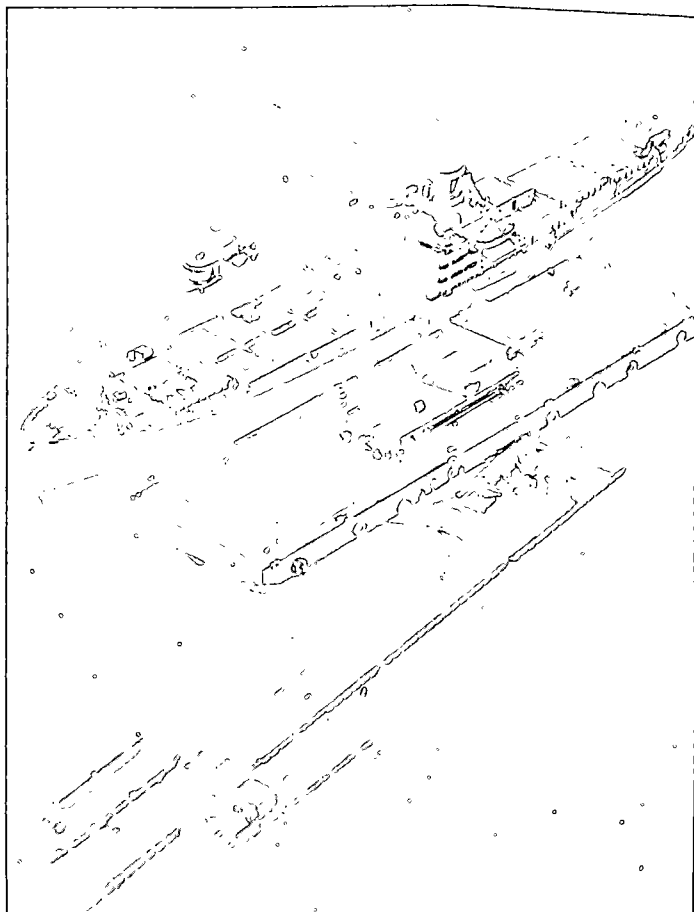


Figure 6-7. Mobile crane aboard floating DeLong pier. In this case, a mobile crane aboard a floating DeLong platform extracted a 20-foot container at a 95-foot reach. This arrangement works well in seas below 3 feet. The crane must be placed aboard before arrival of the platform at the LOTS site. The DeLong platform is not self-propelled and must be towed to the LOTS site. Note in the foreground a ferry causeway attached to a working platform. (US Army photograph.)

- Mobile crane positioned aboard an auxiliary hull to be made fast to the container ship in such a way that the crane can offload containers onto trans-hydro craft.

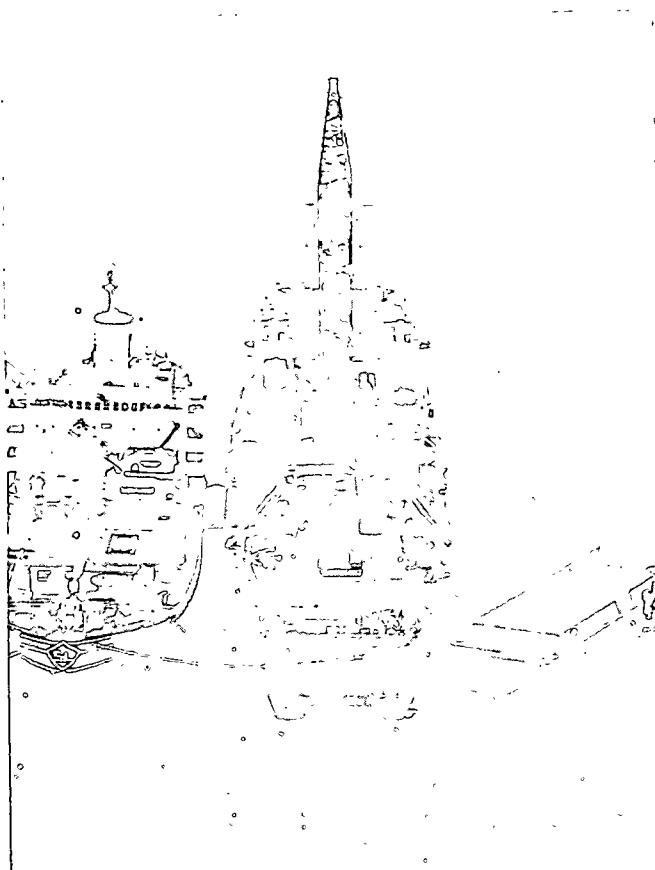


Figure 6-8. Mobile crane aboard auxiliary hull. This is another technique of offloading non-self-sustaining container ships that was tested in OSDOC II. In this case a mobile crane was placed aboard an LST, which was moored alongside the container ship in such a way that containers could be extracted and set aboard trans-hydro craft. This technique is not as effective as others and has the distinct disadvantage of diverting the hull from other uses. (US Army photograph.)

- Floating 100-ton crane (tested at the Coronado Beach, California, dry-run for OSDOC II)

- Direct movement by helicopters

The state of the art is such that a terminal

service company working in the LOTS situation can achieve a 6-minute offload cycle of containers. This compares with a design average of 5 minutes in a fixed port (onload or offload). Commercial operators working under ideal circumstances achieve approximately 3 minutes.

The LOTS site may well be required to work roll-on/roll-off (RORO) ships, which are especially valuable in the early stages of theater buildup. This type of vessel conveys loaded trucks or trailers to the theater. Ideally, the vessel marries up to a causeway or ramp across which the vehicles can be quickly discharged without lifting. Marriage with a beaching craft such as the LCU 1646 class should also be considered. But if no ramps are available, forcing a vehicle-by-vehicle lift, the principle advantage of RORO is lost.

6-6. Transport to the Marshaling Area

Once offloaded, containers must be delivered to a marshaling area, the criticality of which will be shown in the next paragraph. As already mentioned, movement to marshaling may be—

- Direct (not stopping at the shoreline)
- Indirect (mode transfer at the shoreline)

Indirect movement starts with watercraft and requires extra people and equipment to get the containers transferred to shore. Traditionally, landing craft are unloaded at the water's edge with rough terrain forklifts or cranes or with crawler cranes. Containers may be placed on chassis at shipside, however, so that they may be towed off the lighter and to the marshaling area without relifting. OSDOC II also tested an ACV, a floating causeway ferry (which permitted containers to be loaded onto chassis at shipside and rolled off at the beach), and a jacked-up pier (much like coastal oil rigs) established beyond the surfline and linked by causeway to the shore.

At the water's edge, a typical LOTS site will be required to support various traffic-materials handling equipment, trucks, etc. Rarely will soil and sand trafficability be adequate to the task. Various types of airfield landing mats have been used with varying degrees of success in the past. OSDOC II also tested a fiberglass spray-on resin coating product (trade name ON-FAST) which provided a firm, tough traffic base at the water's edge. In any case, some type of surfacing will be needed to sustain the frantic pace at which containers must come ashore (chap 11).

The terminal service company is equipped with yard tractors and yard trailers to move containers between the beach load/unload point and the marshaling area. This equipment is not intended for LOC use, but only for water terminal operations located at ports or beaches.

6-7. Marshaling Area: Getting It All Together

The container marshaling area is to the LOTS site what the classification yard is to the railroad. It is the interface between inbound cargo and retrograde; it is the juncture between the sea LOC and the land LOC.

There are two concepts for marshaling containers—on chassis and stacked:

Stacking requires less space and fewer chassis, but it requires more specialized equipment (frontloaders, sideloaders, and straddle loaders) and more handling. When marshaling area real estate is restrictive, containers may be stacked two-high or three-high. The higher the stack, the greater the space savings—and the greater the complexity of the sorting and rehandling problem. *The Army concept is to stack two-high.*

On-chassis marshaling requires more space and more chassis but less handling.

Because of the rapid rate of discharge and the necessity for quick turnaround of ships, coupled with inland delays of chassis, some stacking is inevitable. Therefore, stacking is the technique of operation currently selected by the Army. Nevertheless, *throughput express of selected containers is also a capability and doctrine where warranted.*

Marshaling Area Functions (Incoming Cargo)—

- Offer container to movement control agency for assignment to clearance mode.
- Unload containers from trans-hydro craft or from shuttle vehicles from water's edge.
- Marshal containers by destination, forwarding mode, priority, and commodity.
- Record receipt, condition, and location of container.
- Maintain current container inventory. Either manual or automated techniques may be used, but it is essential that frequent (twice a day) physical inventories be made to verify the identity and location of containers. Video scanning devices may contribute speed and accuracy to this important function.
- Load container onto chassis/transporter for highway movement via LOC or for movement to railhead, airhead, or sling-out area, as appropriate.
- Accomplish necessary documentation for accounting and onward movement.
- Provide security for the cargo where required.

Obviously, the marshaling area will be a beehive of interactions. Terminal service, movement control, and line haul representation are certain. Supply, military police, and host nation representation may be desirable.

6-8. Summary

Planning for handling containers in a LOTS operation must assure that—

- Non-self-sustaining ships can be worked.
- Effective means of accomplishing the lighterage—the extra step—are on hand.
- The beach is prepared to support the heavy traffic.
- Traffic patterns enhance the flow of containers to the marshaling area.

- The marshaling area can accomplish its function of *handling, organizing, and accounting for* containers, offering them for *movement*, and *injecting them* into the theater transportation distribution system.

LOTS is costly, but in many cases it will be the only way to operate. Thoughtful planning and vigorous execution of this decentralized technique of theater resupply can win wars.

★ CHAPTER 7

MARSHALING YARD OPERATIONS

7-1. Introduction

The loading and discharge of container ships is dedicated to rapid, efficient, and controlled movement of containers between ship and shore. The marshaling yard is an essential part of this shoreside operation, providing a place to hold and process containers¹ pending their further movement.

Use of a marshaling yard permits rapid clearing of the beach/wharf, thereby—

- Making ship working space available for its primary purpose.
- Reducing congestion in the area.
- Reducing work slowdowns and stoppages in the area of vessel operation.

The ideal procedure for clearing containers from the beach/wharf area would be to place the container directly on line-haul equipment for through movement to inland destination. In the majority of cases, this is applicable only to throughput express of selected containers. Conceptually, all containers should move through the terminal with minimum delay. However, this is not always possible in Army container operations because—

- Line-haul transport equipment is not normally available in sufficient quantity. (An exception is made where commercial operators under contract to the Army furnish their own chassis and tractors.)
- Damaged containers may require repair or restowing of contents prior to further movement.
- Prior to inland movement, containers should be segregated by destination and priority.
- Containers moved overseas sometime require redocumentation prior to inland movement.
- Where required, retrograde containers must be cleaned and fumigated (AR 40-12).

The container marshaling yard is basically a temporary in-transit storage area that—

- Expedites container ship operations by promoting rapid and continuous movement to or from the beach/wharf.
- Levels line-haul peak workloads that would otherwise result from container ship discharge operations.
- Permits selective, controlled, and flexible phasing of container movement to destination or to the vessel.

¹ This chapter does not address containerized shipments of ammunition, explosives, or other hazardous materials which require special handling. Handling of hazardous materials is treated in chapter 12 (to be published).

- Provides an area for container—
 - Maintenance, repair, servicing, and inspection
 - Unstowing/stowing
 - Documentation
 - Cleaning and decontamination²
 - Marshaling for retrograde movement
 - Staging
 - Security

- Provides an area for user level servicing of materials handling and container transporter equipment.

7-2. Organization and Functions of the Marshaling Yard

There is no set organization or physical layout for a marshaling yard.³ Rather, it is laid out to best meet the particular operational requirements within available terrain. Basically, the organization should, by grouping related functions, eliminate lost motion, reduce container handling requirements, and permit a logical flow of containers through the area.

As a minimum, the container marshaling area should provide for the following activities and functions:

- A central control and inspection point with multiple lanes for containers entering or leaving the marshaling yard by motor transport.
- Auxiliary internal check points for containers entering the yard from the beach, from a rail spur, or by helicopter to a landing pad within the yard.
- Traffic circulation plan and control of movement into, through, and out of the marshaling area.
- Marshaling of inbound containers, segregated by type and size, and within these groupings, further segregated by—
 - Priority of cargo.
 - Destination of cargo.
 - Requirements for special handling (that is, mail, security cargo, dangerous (other than ammunition)⁴ cargo).

² The shipper is responsible for cleaning and decontaminating retrograde containers before shipping them to the terminal. However, it can be expected that some cleaning and decontamination will be required in the terminal. Until the terminal service company is authorized necessary equipment, it must be obtained through normal supply channels.

³ When cargo is moved by commercial shipping under Government contract, marshaling is normally the responsibility of the contractor.

⁴ Ammunition is normally handled through a separate terminal dedicated to that purpose.

- Marshaling of retrograde containers, segregated by type and size, with filled containers and empties stacked separately.

- Running inventory of containers by location and status within the yard.

- Security area for containerized sensitive and high-dollar value cargo.

- Electrical outlets for refrigerated containers. (In a logistics over-the-shore (LOTS) environment, it may be necessary to depend upon the self-contained refrigeration unit which is part of the refrigerated container. This will require separate propane or diesel refueling areas.) A refrigeration maintenance capability must also be available.

- Sheltered facilities for inventory and control, documentation, and movement control elements.

- As required, sheltered facilities for stowing and unstowing containers.

- Cleaning and/or decontamination of retrograde containers.

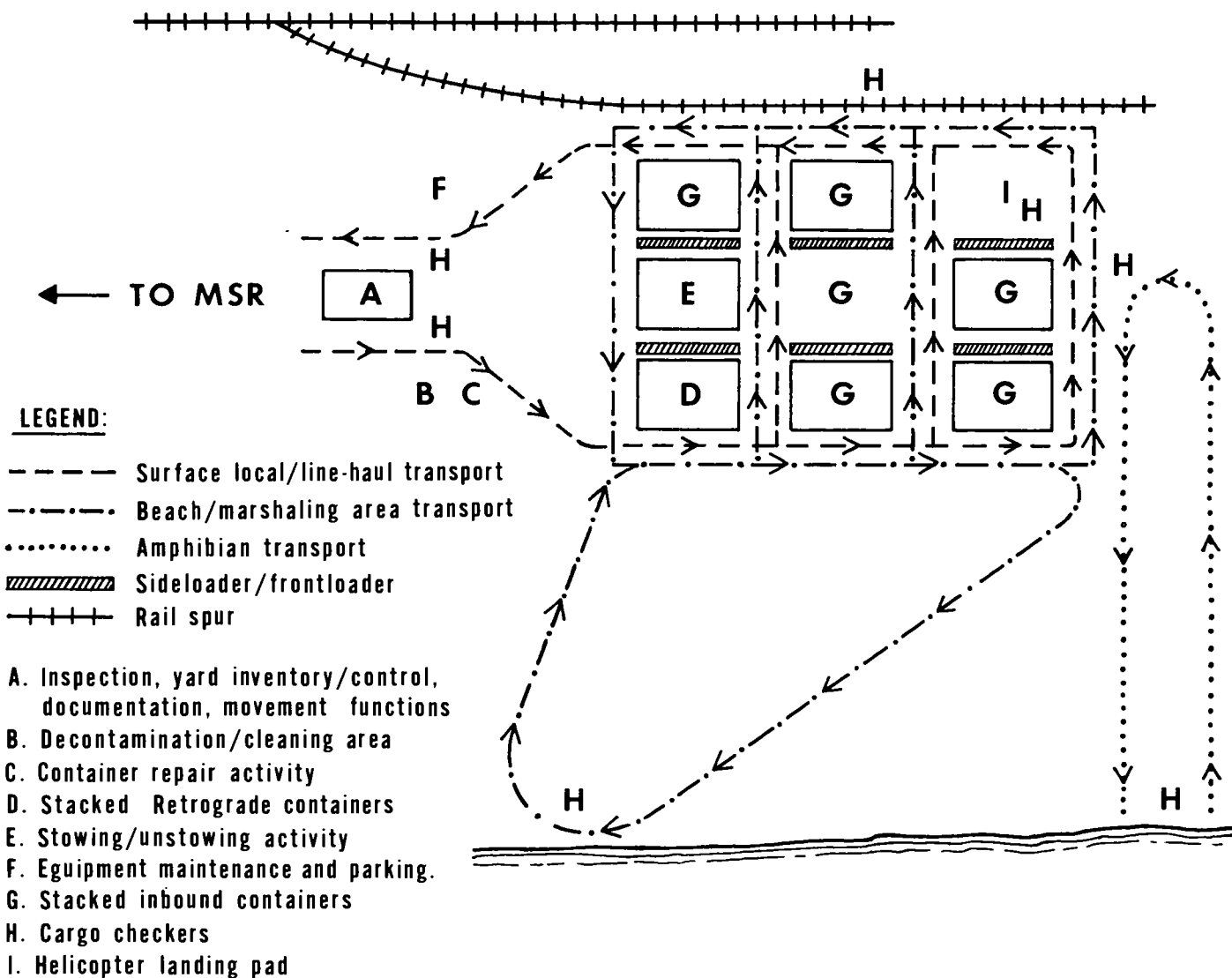
- Minor repair of damaged containers (app D identifies repair limits).

- Equipment parking.

- Organizational maintenance of equipment.

- Messing and comfort facilities.

Figure 7-1 presents a suggested general scheme of layout for a container marshaling yard in a LOTS environment.



NOTE: 1. Not to scale

2. Inbound line-haul equipment is staged along the roadway outside the marshaling area, with controlled entry into the yard.

Figure 7-1. A suggested organization for a container marshaling yard in a LOTS environment. This layout is presented only as a guidance in planning. In practice, the marshaling area is tailored to the situation as permitted by available real estate and environmental factors. Container stacks may be arranged by vessel, with the inbound/outbound stacking array incorporated into the vessel stacking array. When possible, segregate the stowing/unstowing activity by means of a fence to enhance security.

7-3. Location of the Container Marshaling Area

The marshaling area is located as near the vessel, rail, air, or truck discharge/load site as possible. In a theater of operations, enemy capabilities may require some dispersion of activities, or may otherwise affect selection of the location.

Fixed and semifixed container ports. The marshaling yard in an existing fixed container port is normally adjacent to the wharf area, with enough pier space (100 to 300 feet (30.5 to 91.4 meters) wide) between the yard and shipside to accommodate ship discharge and container clearance activities (fig 5-6 and 5-7). Rail spurs, warehouses, and similar physical facilities usually exist but may require rehabilitation.

The semifixed port is constructed to replace a LOTS site when no suitable fixed port is available for that purpose. Layout and construction of the semifixed container port closely parallels that of the fixed port. Construction of the marshaling yard takes advantage of any existing hardstand, structures, rail lines, and the like.

Logistics over-the-shore (LOTS) terminal. Ideally, the LOTS marshaling yard is approximately one-quarter to one-half mile (.4 to .8 kilometer inland from the beach/dune area; to maintain a reasonably acceptable rate of beach clearance, the maximum distance should be no greater than within operational necessities, or as the geographical area may dictate.

A LOTS type operation is intended for use only until existing port facilities can be placed in operation, or until semifixed port facilities can be constructed. Port operational necessities, to include facilities construction, etc., will specify the length of time that LOTS marshaling yards will exist.

Factors influencing the selection of a marshaling yard site in a LOTS environment include—

- *Accessibility.* Is the area—
 - Readily accessible from the main supply route (MSR) and (for LOTS operations) from the beach? Are internal road nets adequate?
 - Free of flight obstructions? (Particularly for helicopter operations.)
- *Physical facilities.* Are there usable physical facilities available (served, where possible, by more than one controlled entrance/exit, for flexible operations and rapid evacuation if required), such as—
 - Hardstands? Airfields?
 - Railways or rail spurs?
 - Buildings, storage sheds, warehouses?
- *Adequacy of space.* Will available space—
 - Accommodate the number, size, and type of containers programmed for the area, with adequate working and intersecting aisles?

- Be adequate for administrative activities, repair and maintenance operation, decontamination operations, receipt of retrograde containers from forward areas, storing of container handling equipment, etc.?

- Be adequate outside the marshaling yard to marshal line-haul equipment awaiting entry to the yard?

- *Gradient and drainage.* Is the container stacking area—

- Sufficiently level (with perhaps minor grading) to permit two-high container stacking danger of toppling?

- Surface and subsoil drainage adequate?

- *Soil characteristics.*

- Is the surface soil compactable?

- What is the depth and type of subsoil?

- What are the requirements for soil compacting and/or stabilization, and for surface matting?

- *Engineer support.*

- What engineer support is required?

- Is it available?

- Will support be timely?

- Is support cost-justified?

- In the absence of engineer support, can transportation terminal service units make the site usable?

7-4. Surface Requirements

Fixed and semifixed container ports. Surfacing of existing container ports and those under construction is designed to support commercially operated equipment. Accordingly, its load-bearing capacities will meet all foreseeable Army requirements. Semifixed container port surfacing will have essentially the same load-bearing capacities as that of the fixed container port.

LOTS container operation. In a LOTS environment, the marshaling yard surface may be subjected to loads of up to approximately 218,000 pounds (50,000-pound frontloader with 40-foot container).⁵ Movement of these loads over the yard aisles will entail many hundreds or even thousands of passes, depending on the duration of the operation.

To demonstrate the severity of wear upon the surface of a LOTS marshaling area, the following is quoted from a study by the US Army Engineer Waterways Experiment Station (WES):⁶

“Unsurfaced soil should not be considered for (container) storage and marshaling areas where the design traffic is much more than 200 passes.”

⁵ Normally, over the beach movement of containers is limited to 20-footers or less. However, up to 40-foot containers may be used if required.

⁶ Technical Report H-73-9, Port Construction in the Theater of Operations, Office, Chief of Engineers, US Army, June 1973.

From the above, and because a LOTS environment normally offers only unsurfaced soil, it is plain that surfacing must be provided and that it must be comparable to that in a fixed or semifixed marshaling area. In other words, a minimum surface would normally consist of about 9 inches of rock/shell subgrade, covered with about the same amount of blacktop. Obviously, time does not permit this type of construction in a LOTS environment.

Pending resolution of this problem by US Army engineers, here are some materials⁷ that may prove useful for support of limited loads:

- *Matting, AM-2.* A Navy-developed extruded aluminum airfield mat, designed to support jet aircraft over soft, fine-grained soil (clay and silt). However, because of limited stocks, high cost, and high priority for airfield use, it is probably unrealistic to plan on using this mat in the marshaling area.

- *Matting, XM19.* An Army-developed aluminum honeycomb-core, sandwich-type airfield landing mat designed to support cargo and selected jet aircraft over soft soils. This matting also is in limited stock, with priority for airfield use.

- *Matting, M8A1.* A corrugated steel airfield mat that will support container (8x8x20-foot) loaded trailers over sand, other granular soils, and most relatively dry, fine-grained soils (clay and silt).

- *MO-MAT.* A fiberglass-reinforced plastic emplaced in sections which may be either bolted together or overlapped. It is less susceptible to excess water penetration, and more easily replaced or relocated than metal matting and is effective over beach sand and other granular soils, and some fine-grained soils (clay and silt). It relies mostly on support provided by underlying soils.

- *ON-FAST.* A fiberglass cloth, hand-sprayed with polyester resin for reinforcement. When intact, it does not allow water penetration. It relies mostly on support provided by underlying soils and is effective over beach sand (para 11-8) and other granular soils, and some fine-grained soils (clay and silt). Increased matting strength (or repair) can be obtained by varying the thickness and fiberglass reinforcement.

7-5. Container Stacking Configurations

Containers may be placed in the marshaling yard either on-chassis or stacked off-chassis.

⁷ All surfacing materials, except ON-FAST, are in military inventories. All systems require ground leveling before emplacement. All systems require engineer support for their installation. Experience has shown that if waterproofing is not used under metal matting, support of underlying soil will degrade and result in early surface failures. All systems are susceptible to damage if crossed by tracked vehicles with cleats.

A large number of commercial operators retain containers on-chassis, thereby reducing container handling requirements and, to a degree, speeding up the operation. However, when containers remain on-chassis throughout the system, this procedure requires a chassis for approximately every two to three containers in the system. Also, using the on-chassis method increases space requirements.

The Army operational concept is to stack off-chassis, two containers high. Retrograde containers, when empty, can be stacked three-high by proposed container handling equipment; therefore, to reduce space requirements, it may be helpful to stack retrograde containers three-high. This increases container handling requirements but requires fewer chassis and reduces space requirements.

Primary configurations of off-chassis stacking include—

- Ribbon stacking
- Block stacking
- Turret stacking

Ribbon stacking (fig 7-2)—

- Used where there is no requirement for selective extraction of containers from the stack.
- Requires more space than block stacking, but less than turret stacking.

Block stacking (fig 7-3)—

- Used when containers have a common destination or when, for other reasons, there is no requirement for selective extraction of containers from the stack.
- Particularly suited to stacking identical retrograde containers or empties.

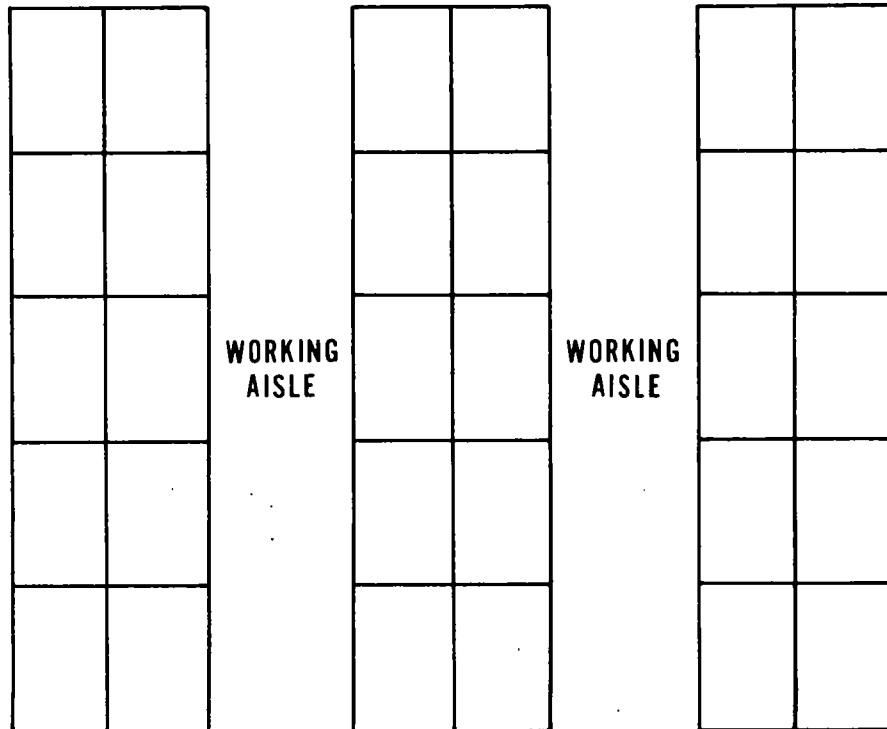
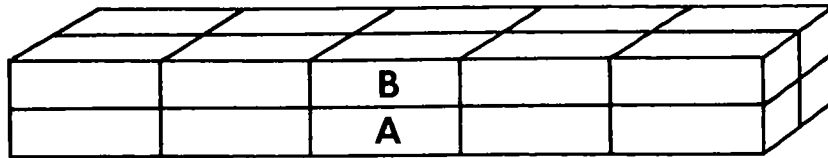
Turret stacking (fig 7-4 and 7-5)—

- Requires less handling for selective extraction of containers than does ribbon or block stacking.
- Recommended for stacking inbound containers.
- Of the three off-chassis configurations, makes least economical use of space, but greatly enhances the marshaling yard's throughput or retrograde operations because it is the fastest and most responsive.

Three-high turret stacking is illustrated in figure 7-5 for information only. The Army concept is to stack two-high (fig 7-4).

The on-chassis container marshaling system (fig 7-6) is employed by a number of commercial operators. When operating under contract with the Army, these operators can be expected to continue to use this system. On-chassis container marshaling is normally employed in—

- Fixed water terminal operations, where the container is lifted off the container ship directly onto a line-haul transporter.
- Roll-on/roll-off (RORO) operations, where the



INTERSECTING (TURNING) AISLE

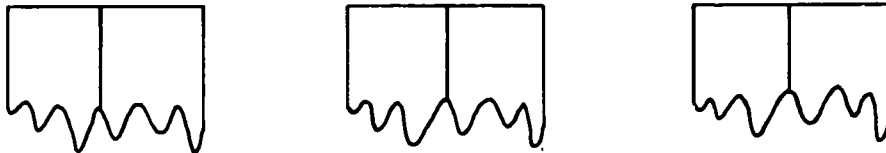


Figure 7-2. Ribbon stacking may be used where there is a requirement to reach all containers in the stack from the working aisle (the aisle between ribbons), but no requirement for extraction of a particular container in the stack. To illustrate, extraction of container A requires that container B first be removed and placed in the working aisle, or carried completely out of the block. At best, this results in increased handling requirements, and in traffic congestion.

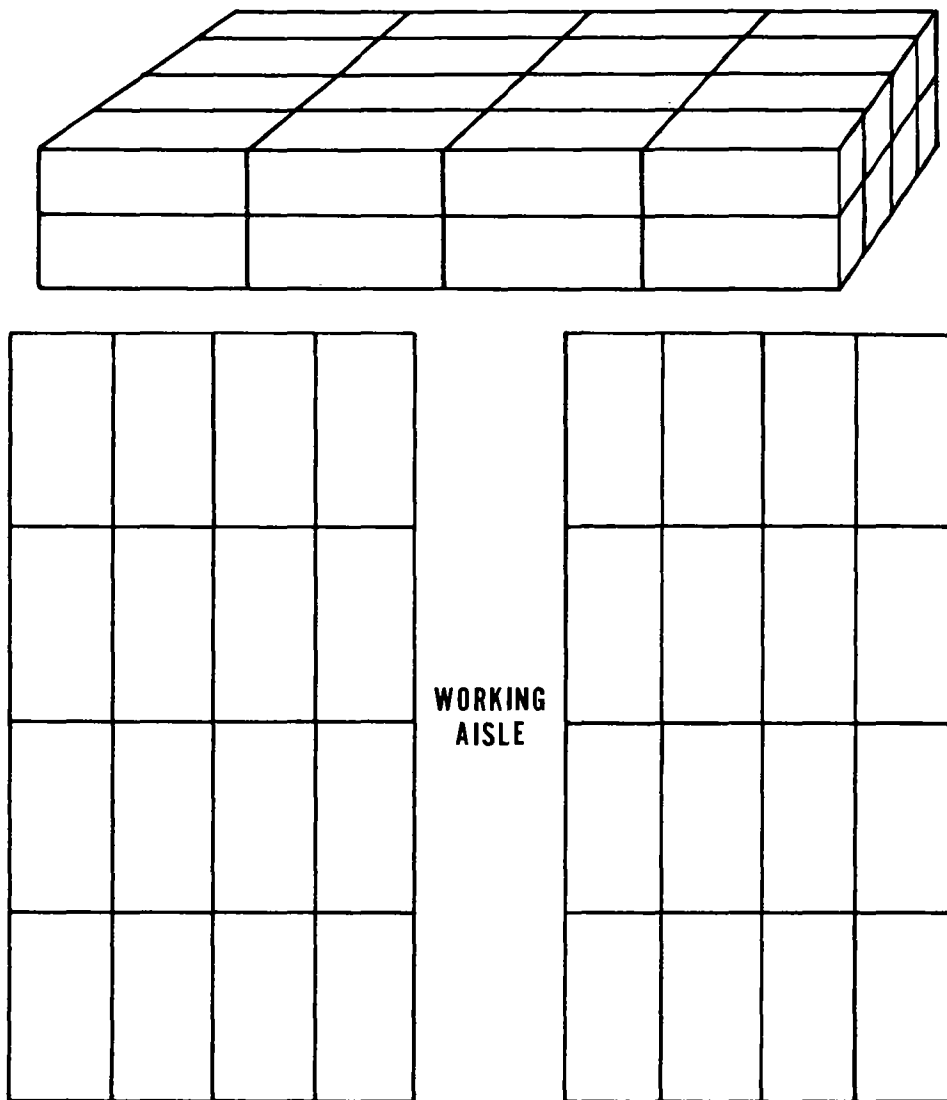


Figure 7-3. Block stacking is ideal for identical retrograde containers or empties, for containers having a common destination, and in other cases where there is no requirement for selective extraction. Of the three stacking methods, block stacking permits the most economical use of space.

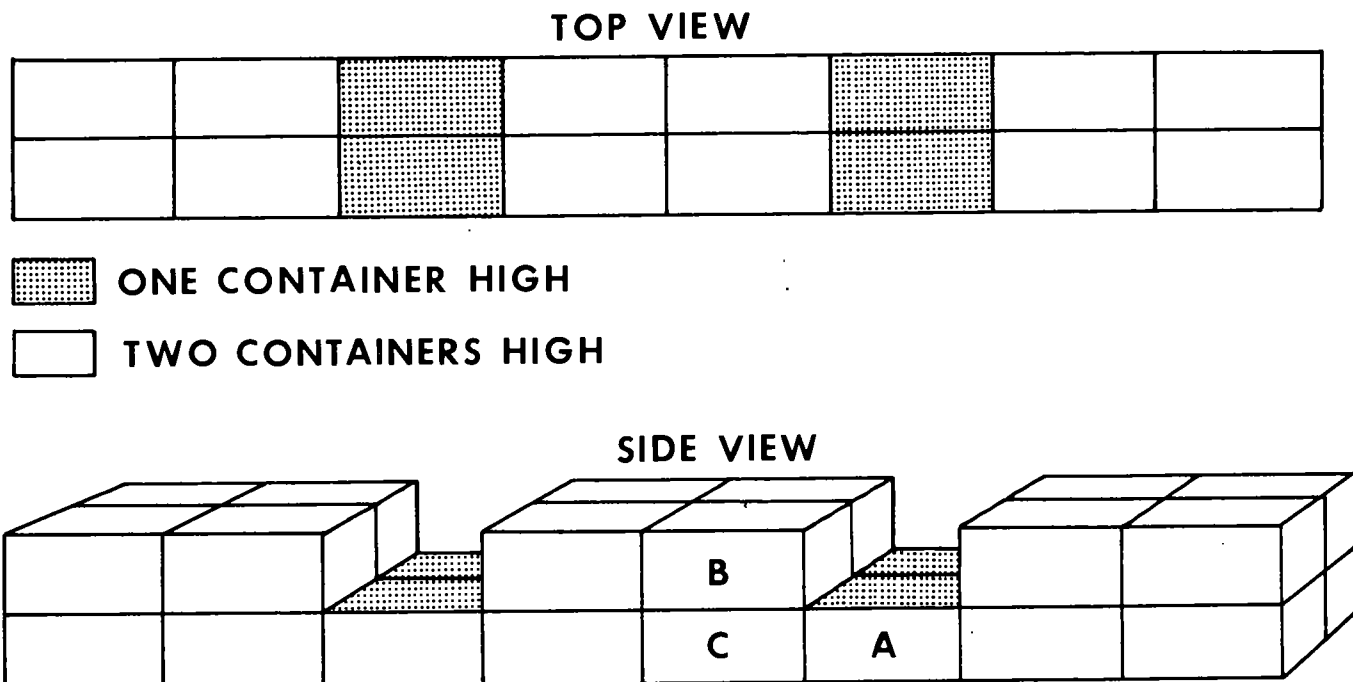


Figure 7-4. Turret stacking (two-high). Although the least economical in space, turret stacking is recommended when containers must be selectively extracted from the stack. As illustrated, one in three spaces in the second tier is left vacant, thus permitting removal of any container in the stack with no more than two movements. For example, to get to container C, simply place container B over container A, thereby exposing container C.

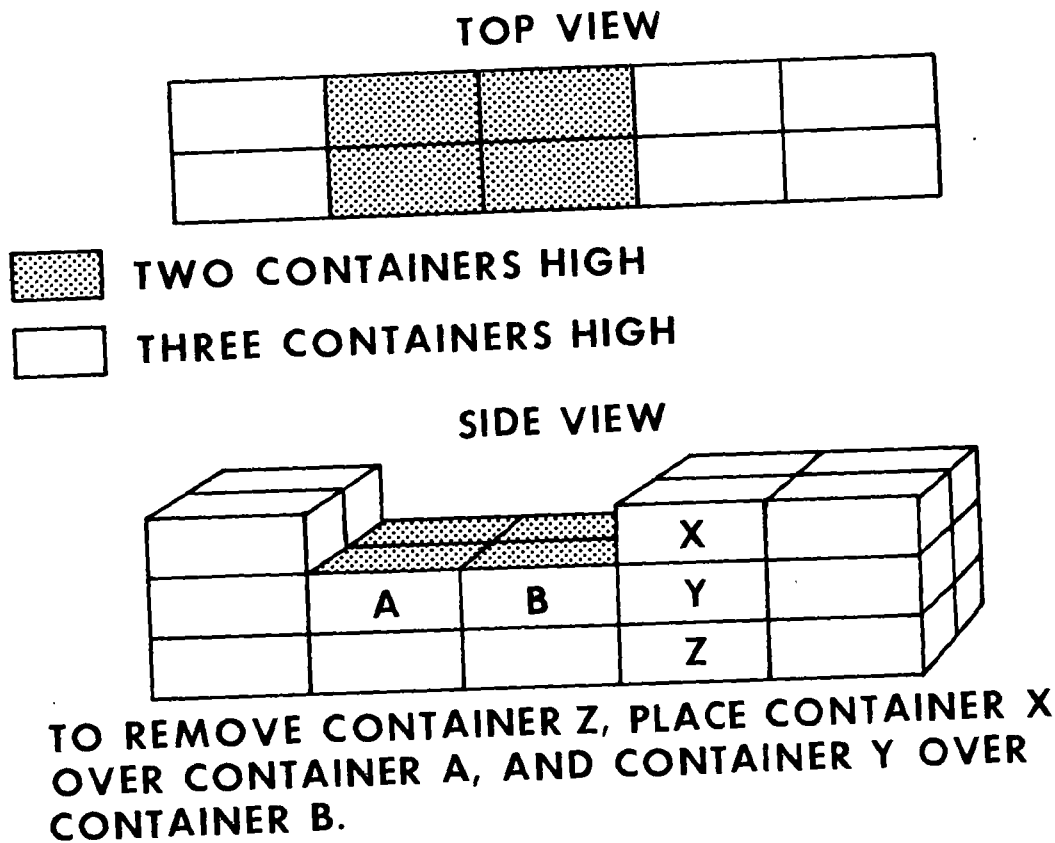
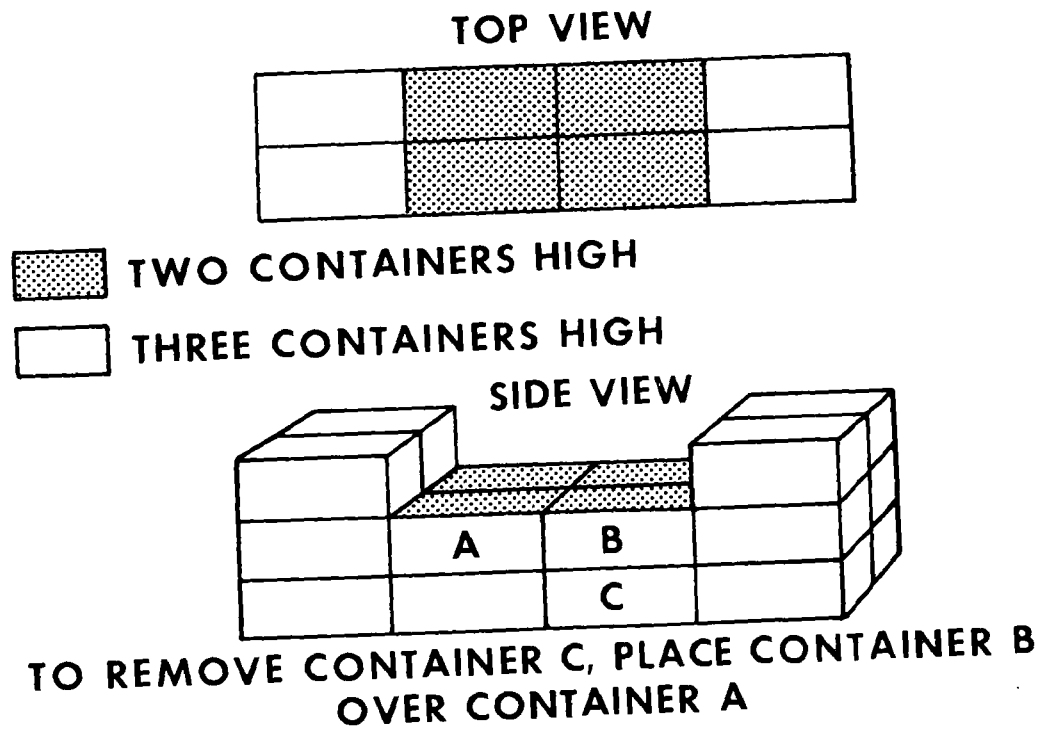


Figure 7-5. Turret stacking (three-high). Here, two spaces out of four are left vacant in the third tier. No more than three movements are required to extract any container. This method can be used in Army operations only when empty, identical containers are being handled.

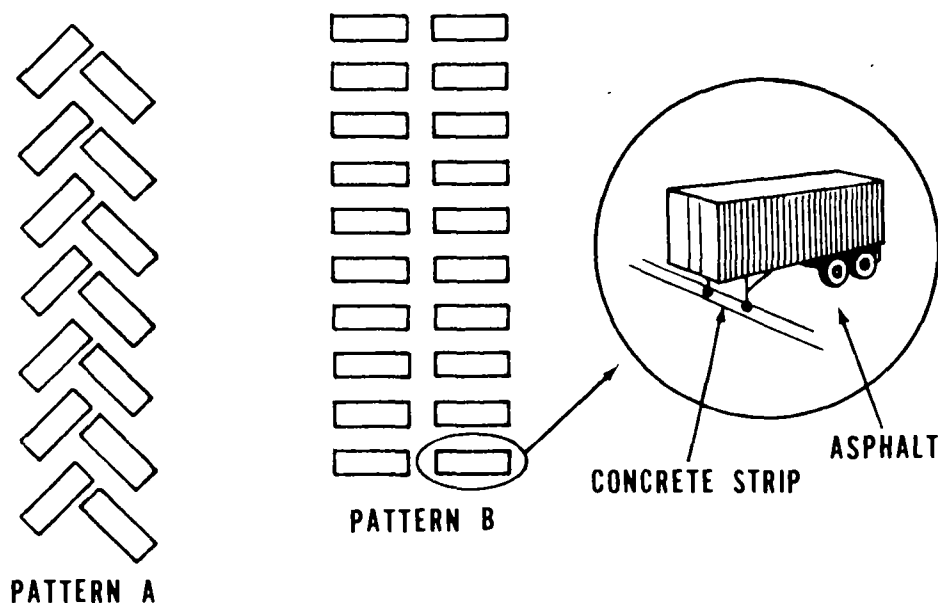


Figure 7-6. Illustrating two patterns of container-on-chassis (also referred to as container-on-wheels) marshaling; that is, herringbone (pattern A) and straight-in (pattern B). One major commercial operator reports significantly reduced container damage experience in the marshaling area by changing from pattern A parking to pattern B. Additionally, the same operator, by using pattern B, is able (in the case of blacktop surfacing) to install a narrow hardened strip to support the legs of parked chassis, thereby preventing their sinking into the blacktop.

container-on-chassis is towed ashore from the RORO ship.

Key features of marshaling containers on-chassis include—

- Reduction of container handling requirements.
- Increased mobility and flexibility of operations.
- Materially increased marshaling space requirements.
- Requirement for a 2 or 3 to 1 container-to-chassis ratio or, under some circumstances, an even more favorable container-to-chassis ratio.

7-6. Container Stacking Space Requirements

Factors that govern container stacking space requirements include—

- Stacking configuration (to illustrate, one-high stacking requires more space than two-high; ribbon stacking requires more space than block stacking; turret stacking requires more space than ribbon stacking).
- Skill of equipment operators. Less skilled operators require more maneuvering space for operation of container handling equipment.

- Physical characteristics of container handling equipment.⁸ To illustrate:

—The sideloader (with or without container) is 12 feet 6 inches wide by 41 feet 3 inches long. Its turning radius is 33 feet. The recommended minimum operating space⁹ is a 15-foot working aisle and a 50-foot intersecting (turning) aisle. See figure 7-2 for illustration of working and intersecting aisles.

—The frontloader is 30 feet 4 inches long by 11 feet wide (without container, but including tires). With a 20-foot container the frontloader is 20 feet wide; with a 35-foot container, 35 feet wide; and with a 40-foot container, it is 40 feet wide. Carrying a 20-foot container in a 90-degree stacking operation, the frontloader has a 45-foot turning radius; with a 35-foot container, the turning radius is 52 feet; with a 40-foot container, 65 feet.

- Size of the container, as discussed above.

⁸ Physical characteristics are based on manufacturer's data pertaining to currently available commercial equipment that typifies Army requirements.

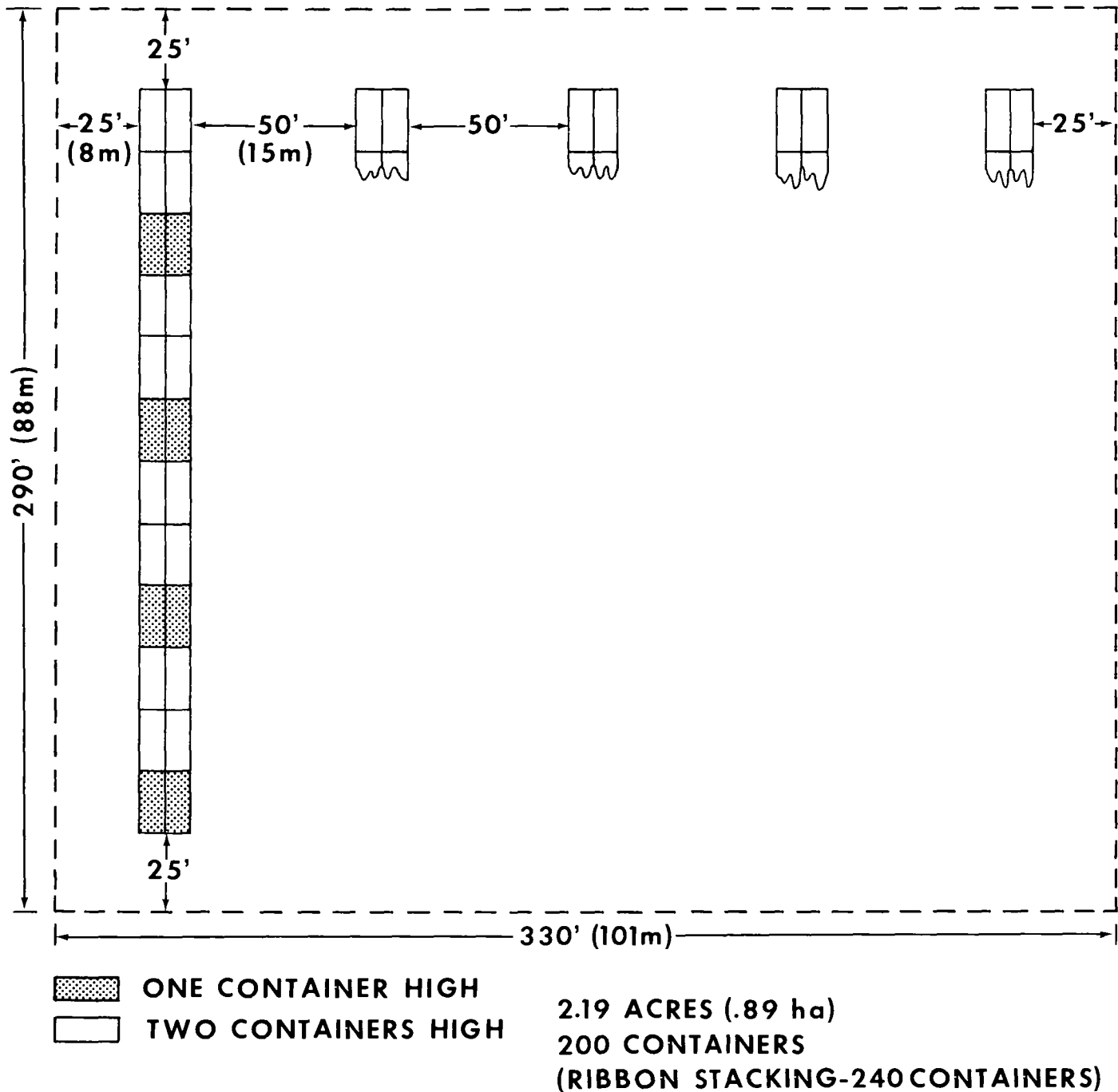
⁹ Recommended operating space for sideloader and frontloader is based on studies conducted by the US Army Engineers and the Naval Facilities Engineering Command.

Figures 7-7 through 7-27 present a conceptual procedure for computing space requirements for stacking containers in the marshaling yard. The concept envisions development of basic "clusters" of containers, which may be grouped as desired to form a marshaling area complex tailored to specific operational requirements and environments.

Clusters are developed for turret stacking, block

stacking, and on-chassis parking, and cover 20-foot, 35-foot, and 40-foot containers. Variations provide for two-high stacking by frontloader and sideloader. The aisles vary—minimum width aisle to conserve space, and a somewhat wider aisle to accommodate less skilled equipment operators.

A sample problem (using the situation in figure 7-8) is presented at the end of this chapter.



Note: "Ha" is an abbreviation for hectare/hectometer.

Figure 7-7. Cluster plan for frontloader turret stacking of 20-foot containers—50-foot aisles.

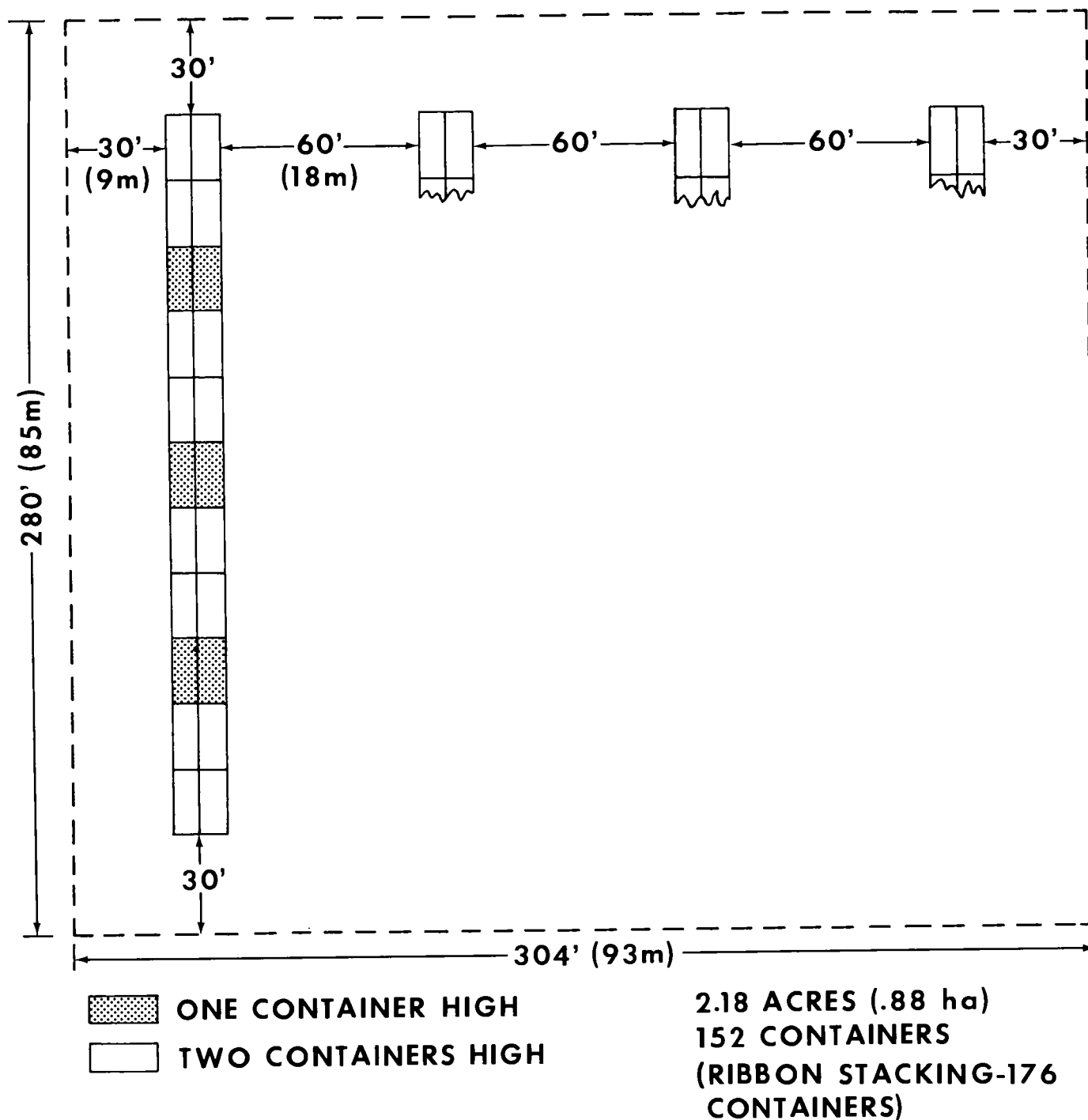


Figure 7-8. Cluster plan for frontload turret stacking of 20-foot containers—60-foot aisles.

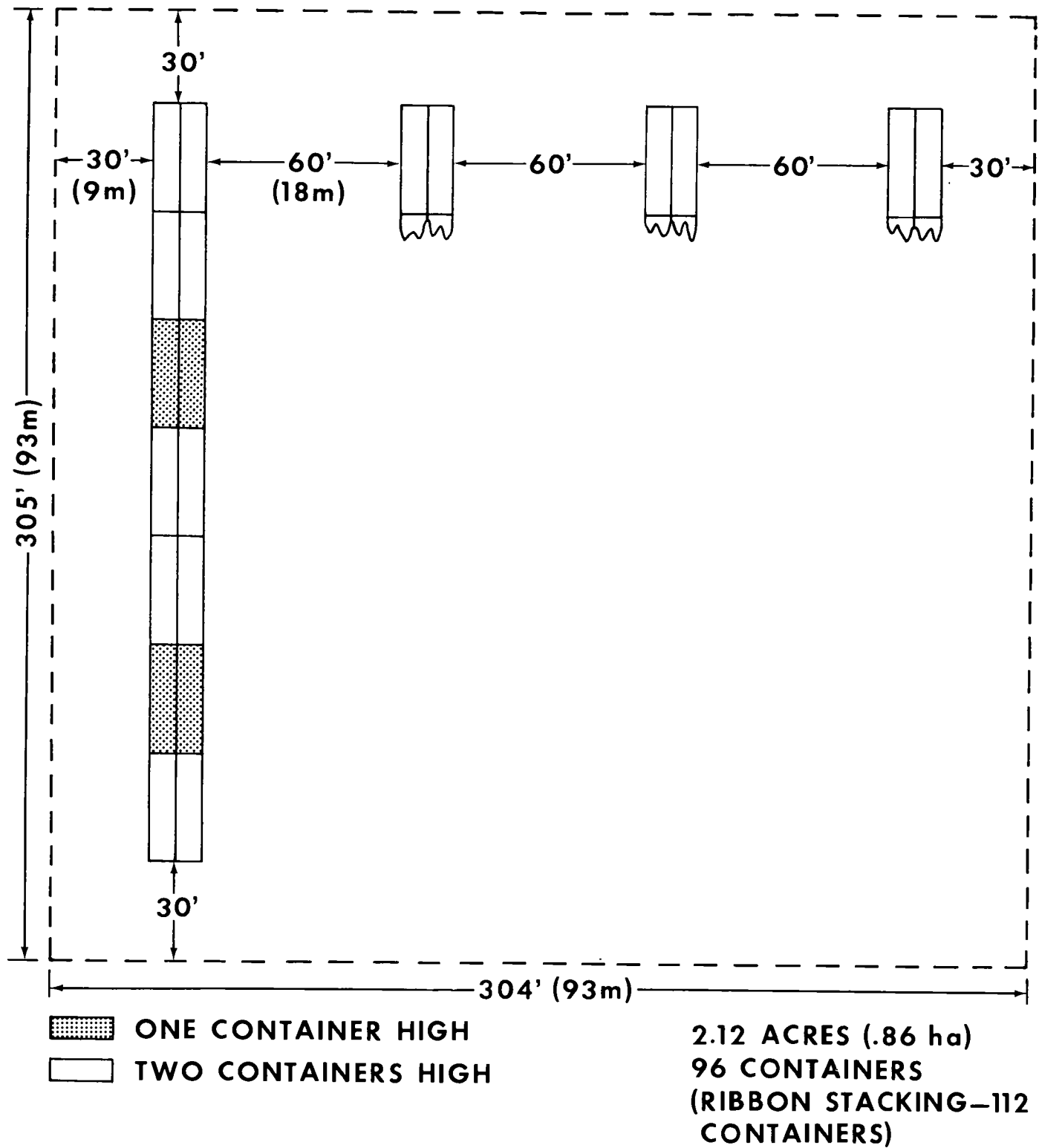


Figure 7-9. Cluster plan for frontloader turret stacking of 35-foot containers—60-foot aisles.

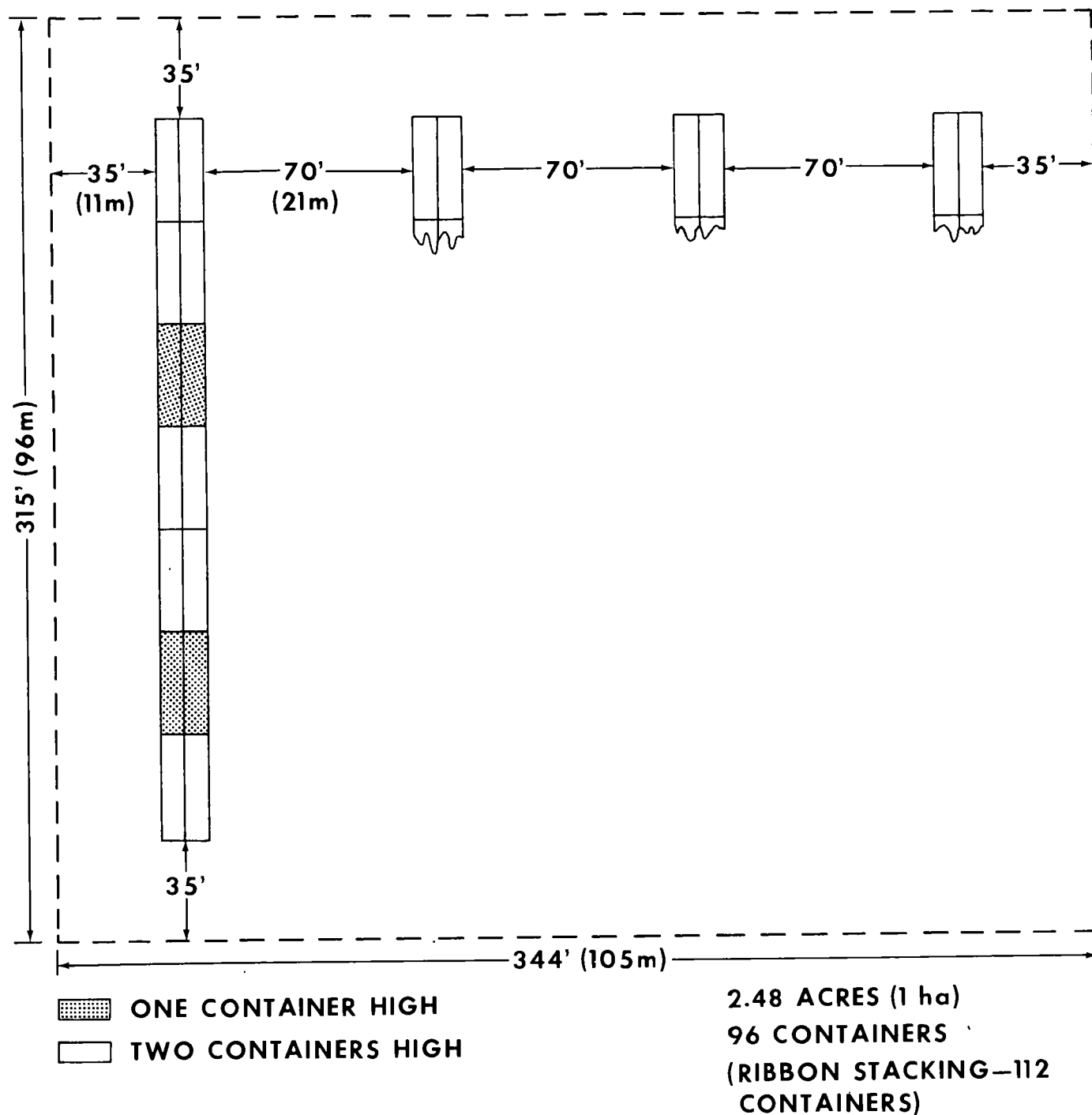


Figure 7-10. Cluster plan for frontloader turret stacking of 35-foot containers — 70-foot aisles.

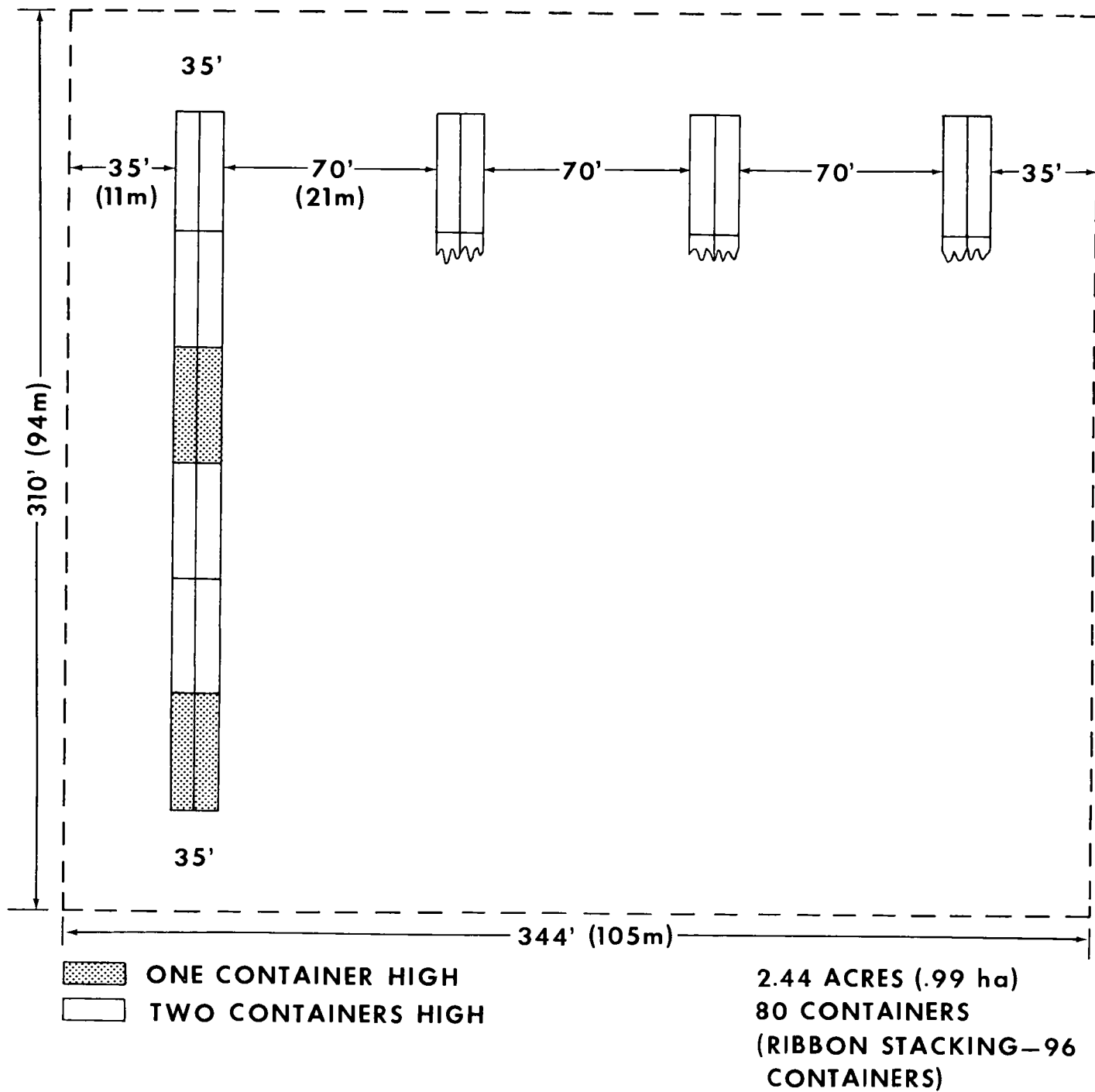


Figure 7-11. Cluster plan for frontloader turret stacking of 40-foot containers—70-foot aisles.

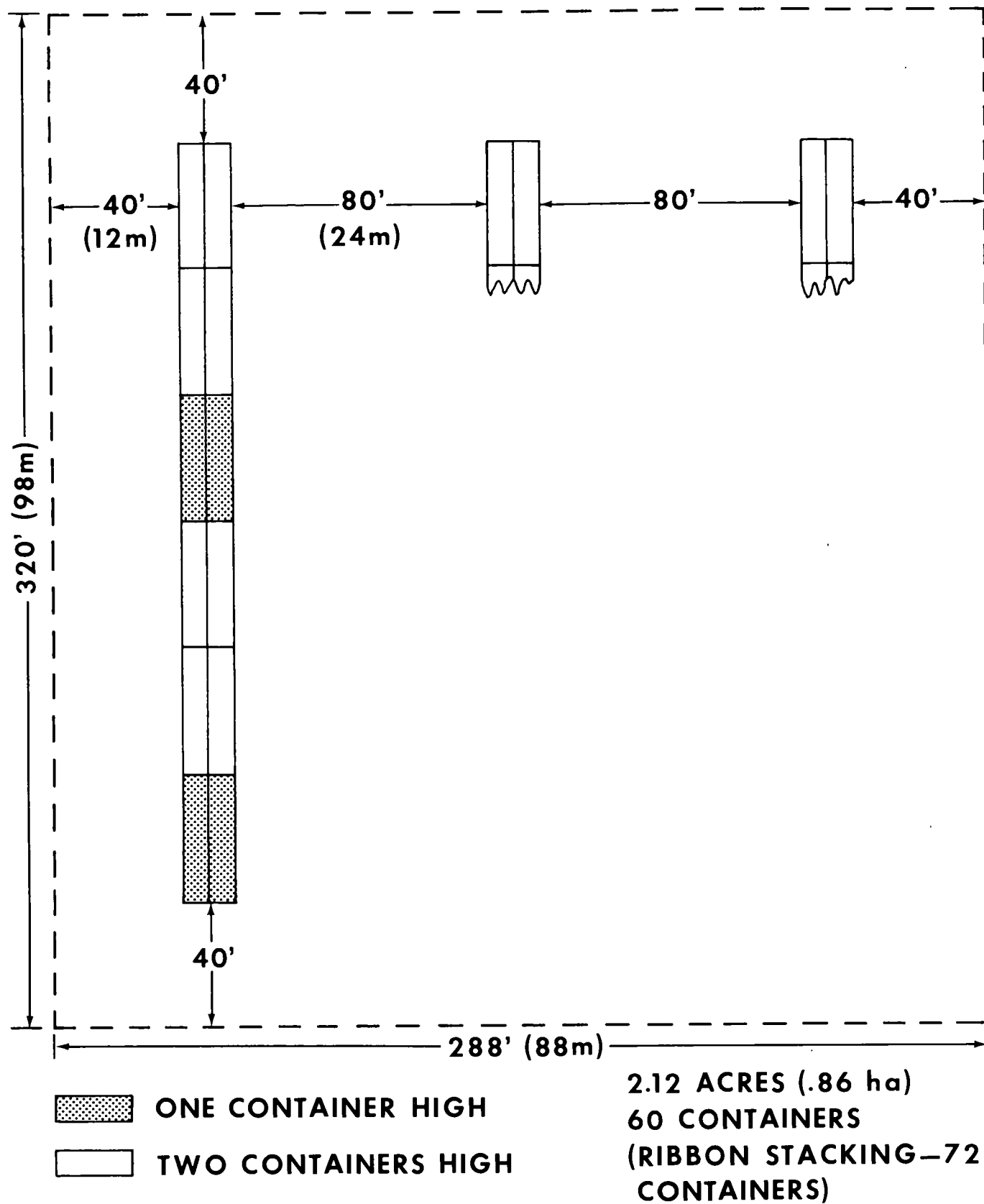


Figure 7-12. Cluster plan for frontloader turret stacking of 40-foot containers—80-foot aisles.

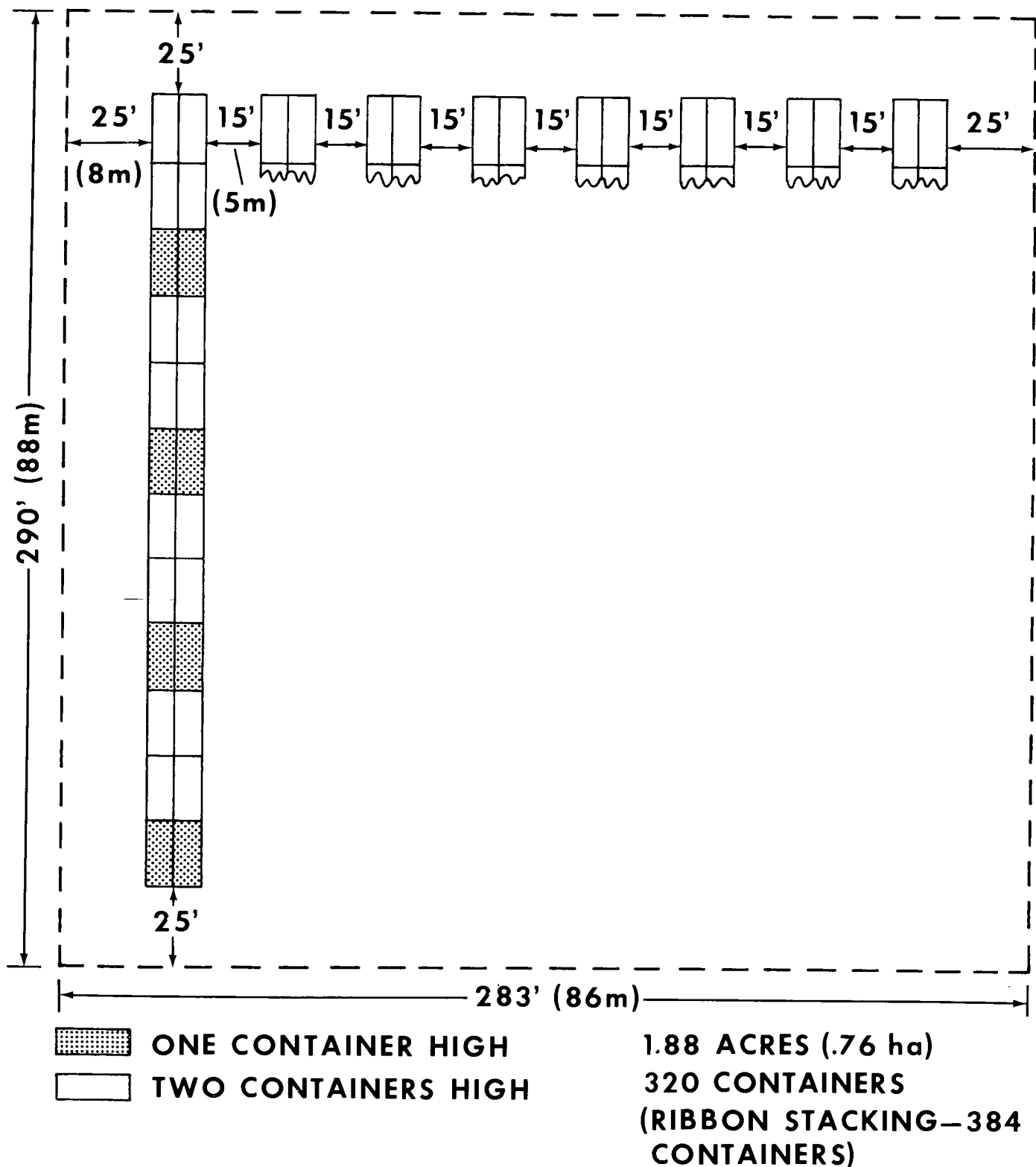


Figure 7-13. Cluster plan for sideloader turret stacking of 20-foot containers—15-foot working aisle and 50-foot intersecting aisle.

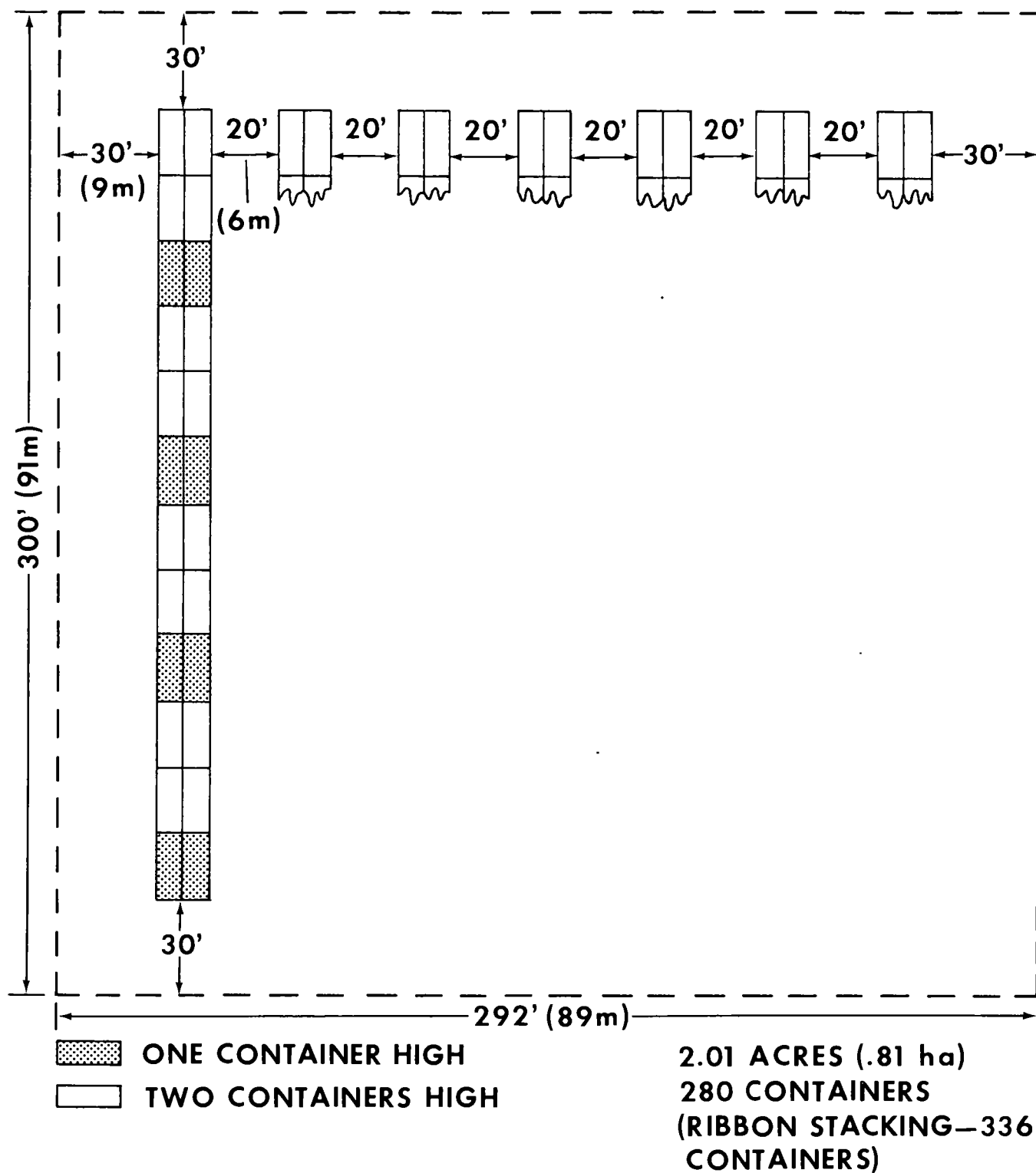


Figure 7-14. Cluster plan for sideloader turret stacking of 20-foot containers—20-foot working aisle and 60-foot intersecting aisle.

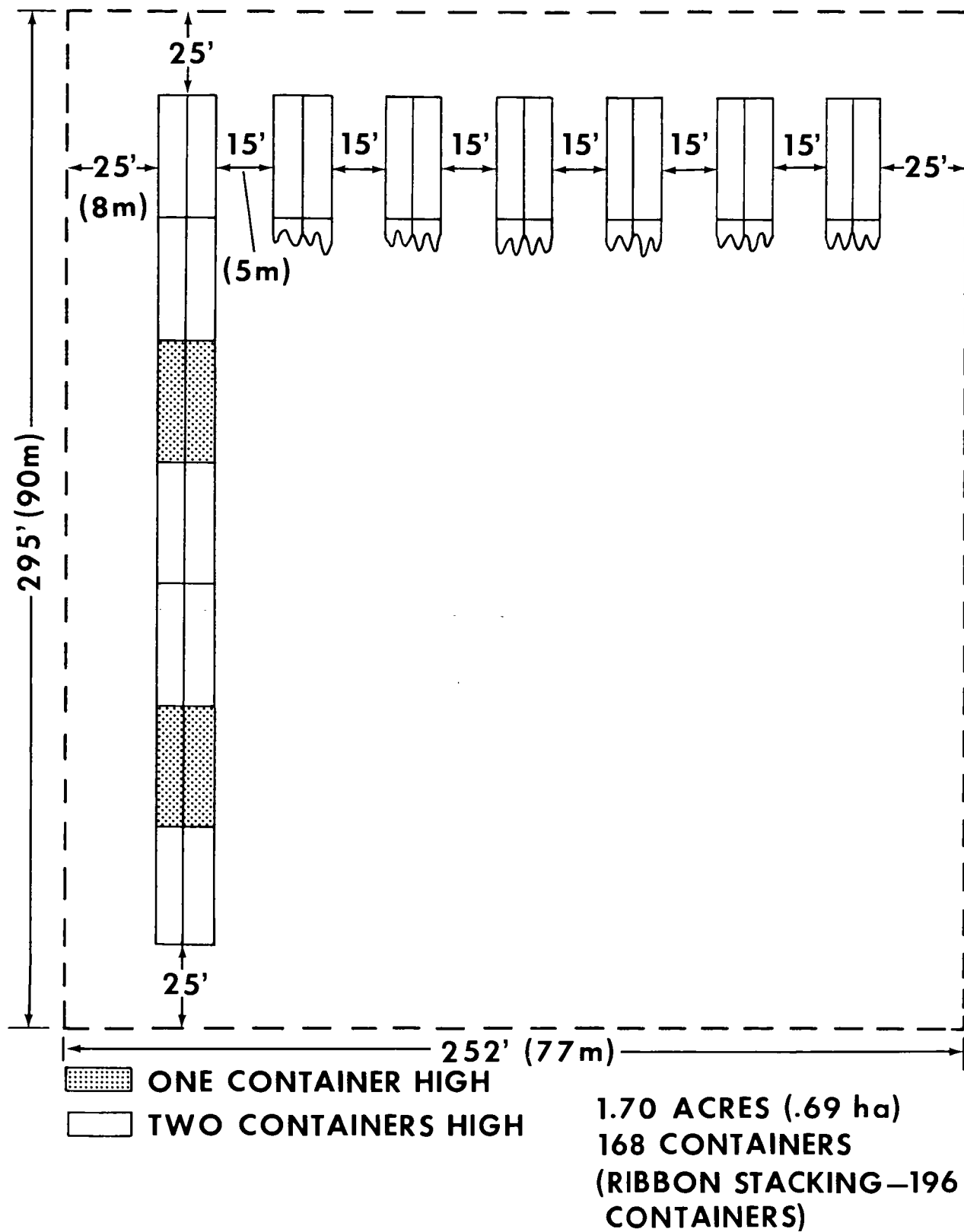


Figure 7-15. Cluster plan for sideo loader turret stacking of 35-foot containers—15-foot working aisle and 50-foot intersecting aisle.

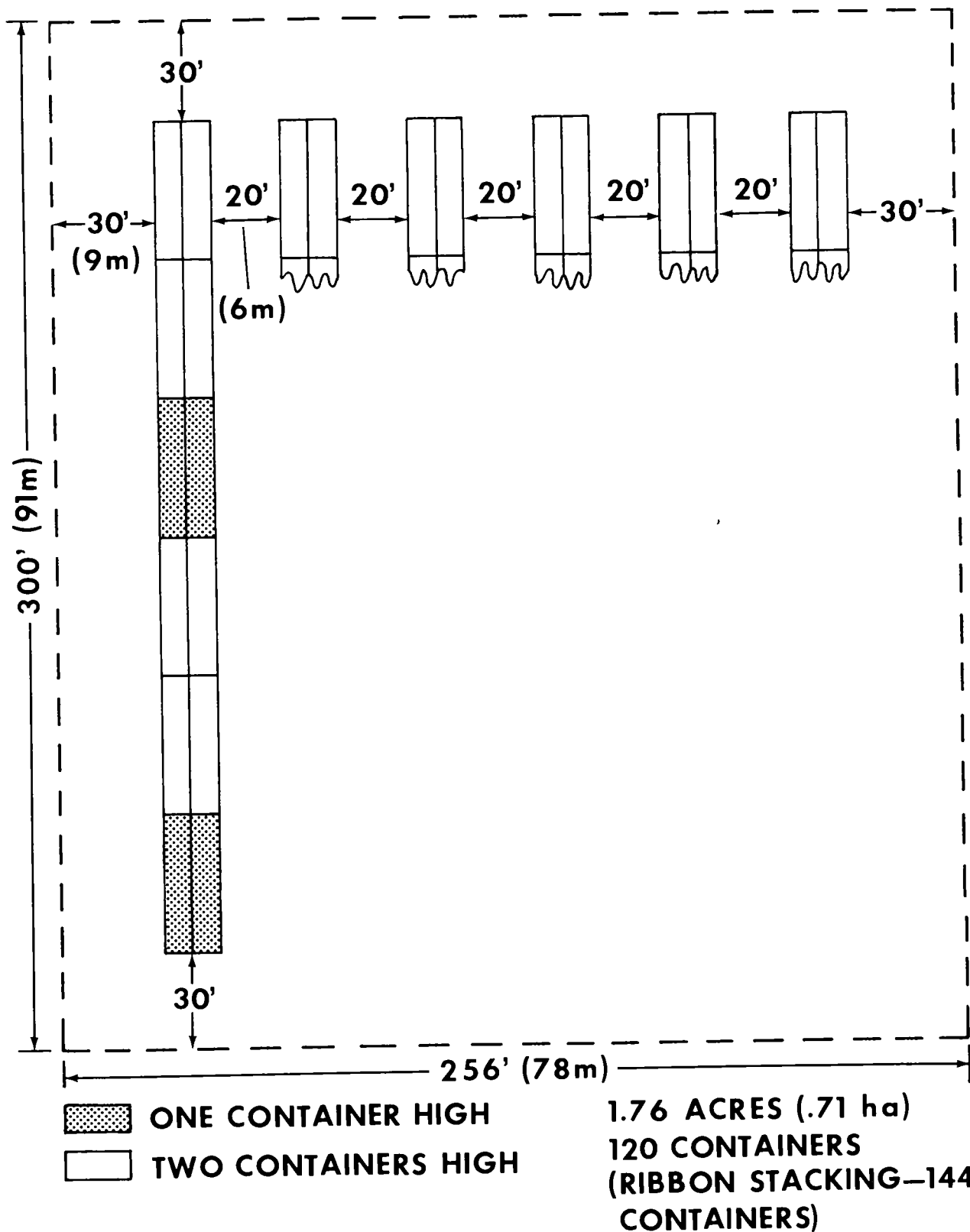
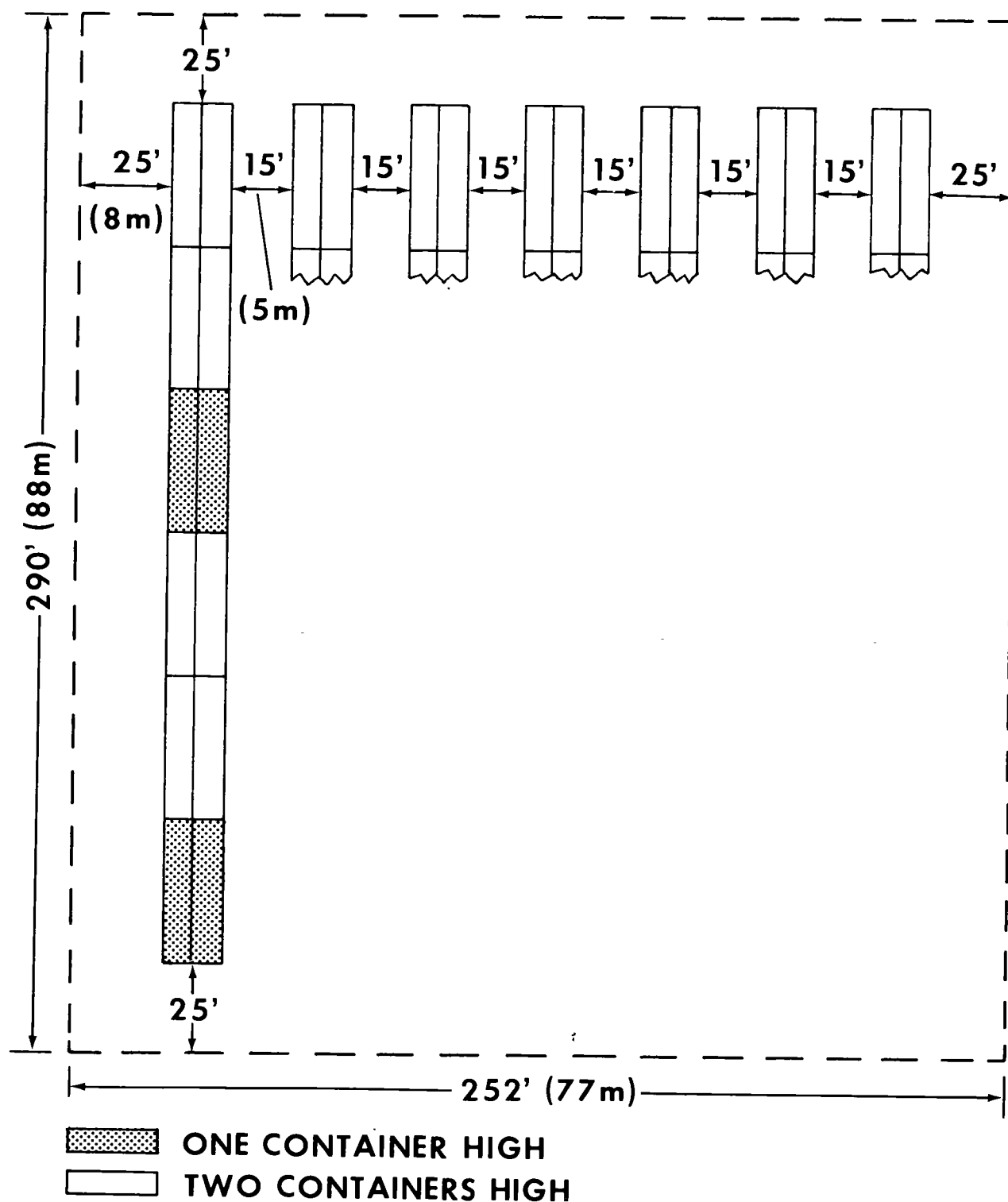


Figure 7-16. Cluster plan for sideloader turret stacking of 35-foot containers—20-foot working aisle and 60-foot intersecting aisle.



1.68 ACRES (.68 ha)
140 CONTAINERS
(RIBBON STACKING — 168 CONTAINERS)

Figure 7-17. Cluster plan for sideloader turret stacking of 40-foot containers—15-foot working aisle and 50-foot intersecting aisle.

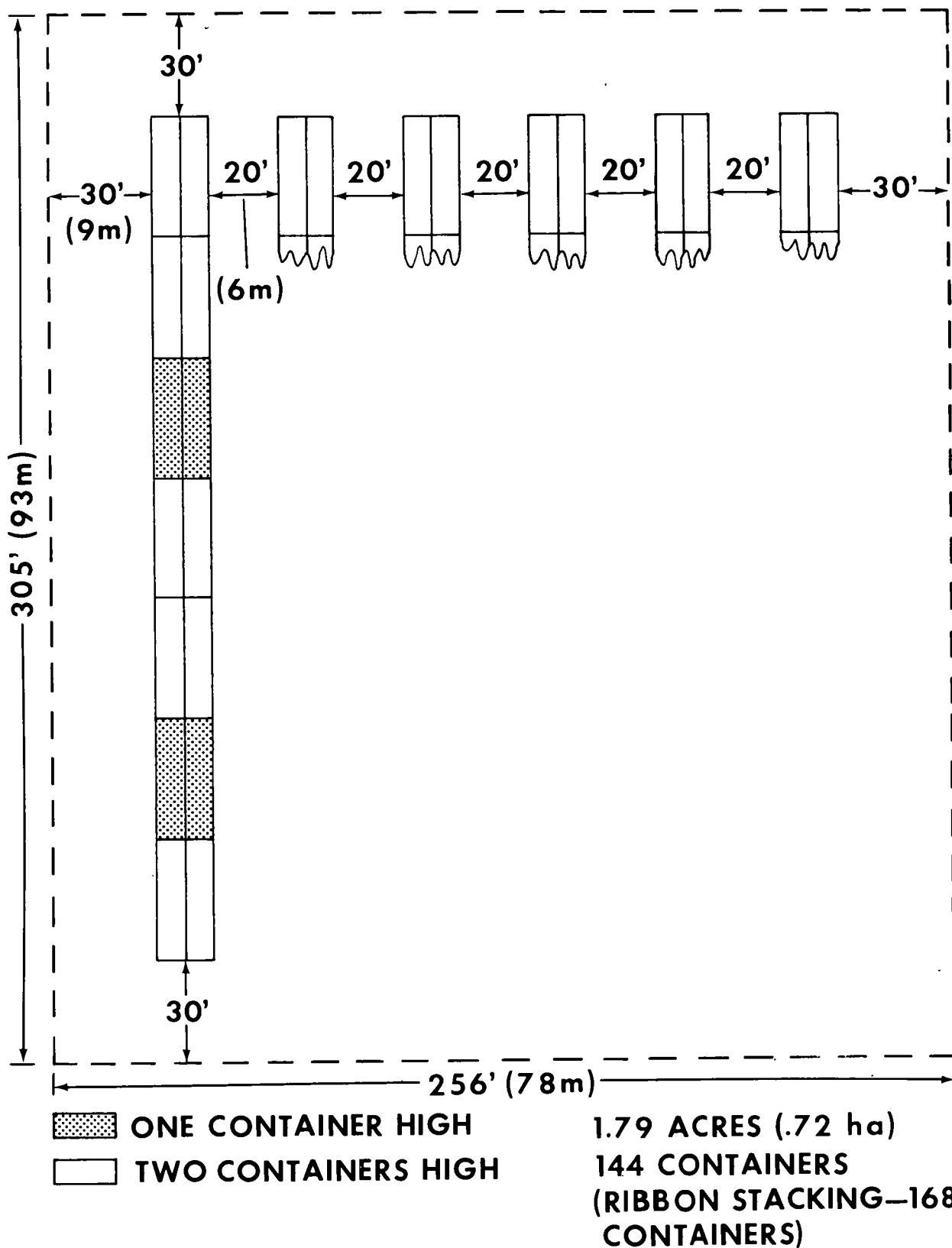


Figure 7-18. Cluster plan for sideloader turret stacking of 40-foot containers—20-foot working aisle and 60-foot intersecting aisle.

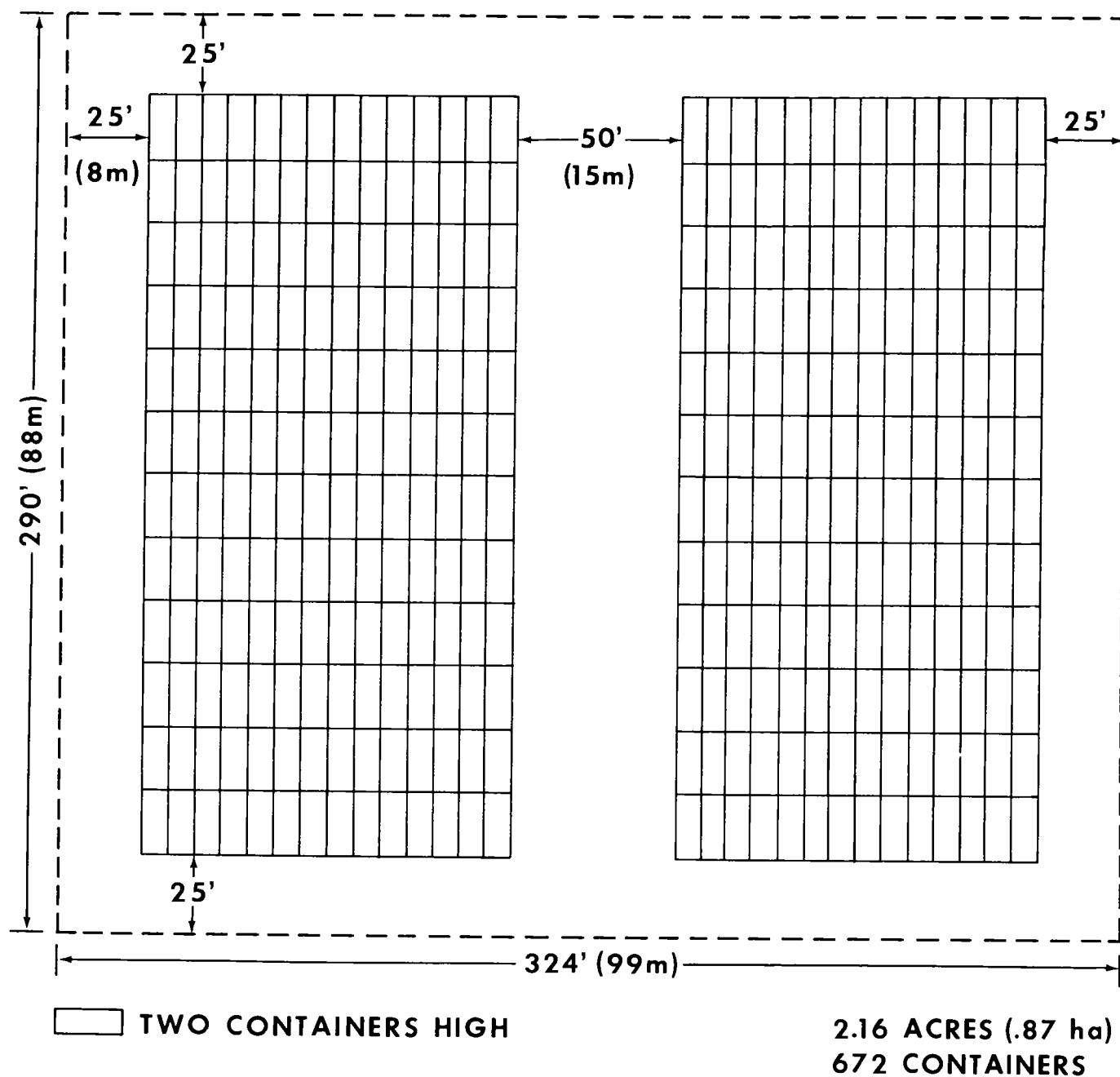


Figure 7-19. Cluster plan for frontloader two-high block stacking of 20-foot containers. This cluster occupies essentially the same space as frontloader turret-stacked 20-foot containers shown in figure 7-7.

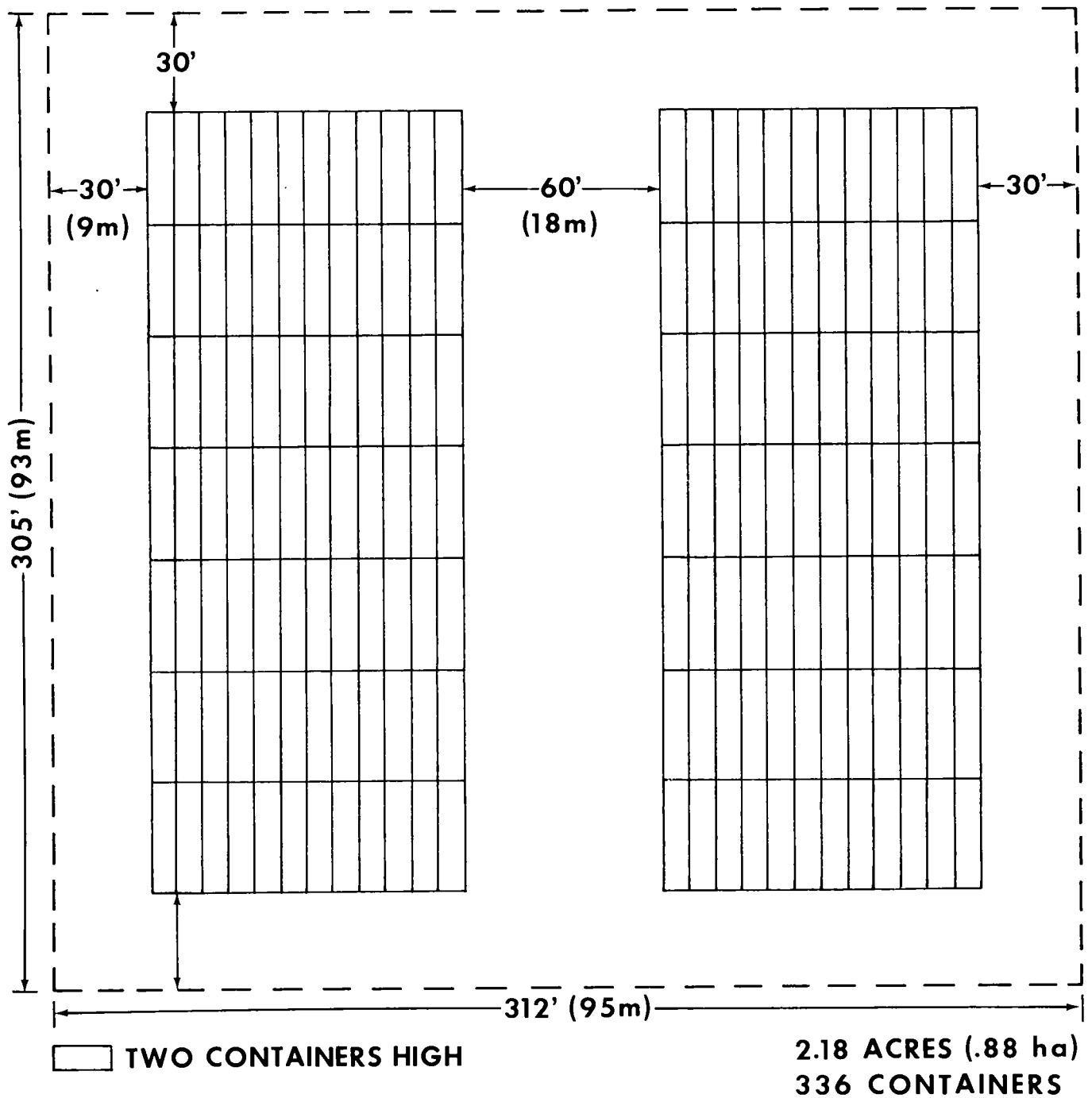


Figure 7-20. Cluster plan for frontloader two-high block stacking of 35-foot containers. This cluster occupies essentially the same space as frontloader turret-stacked 35-foot containers shown in figure 7-9.

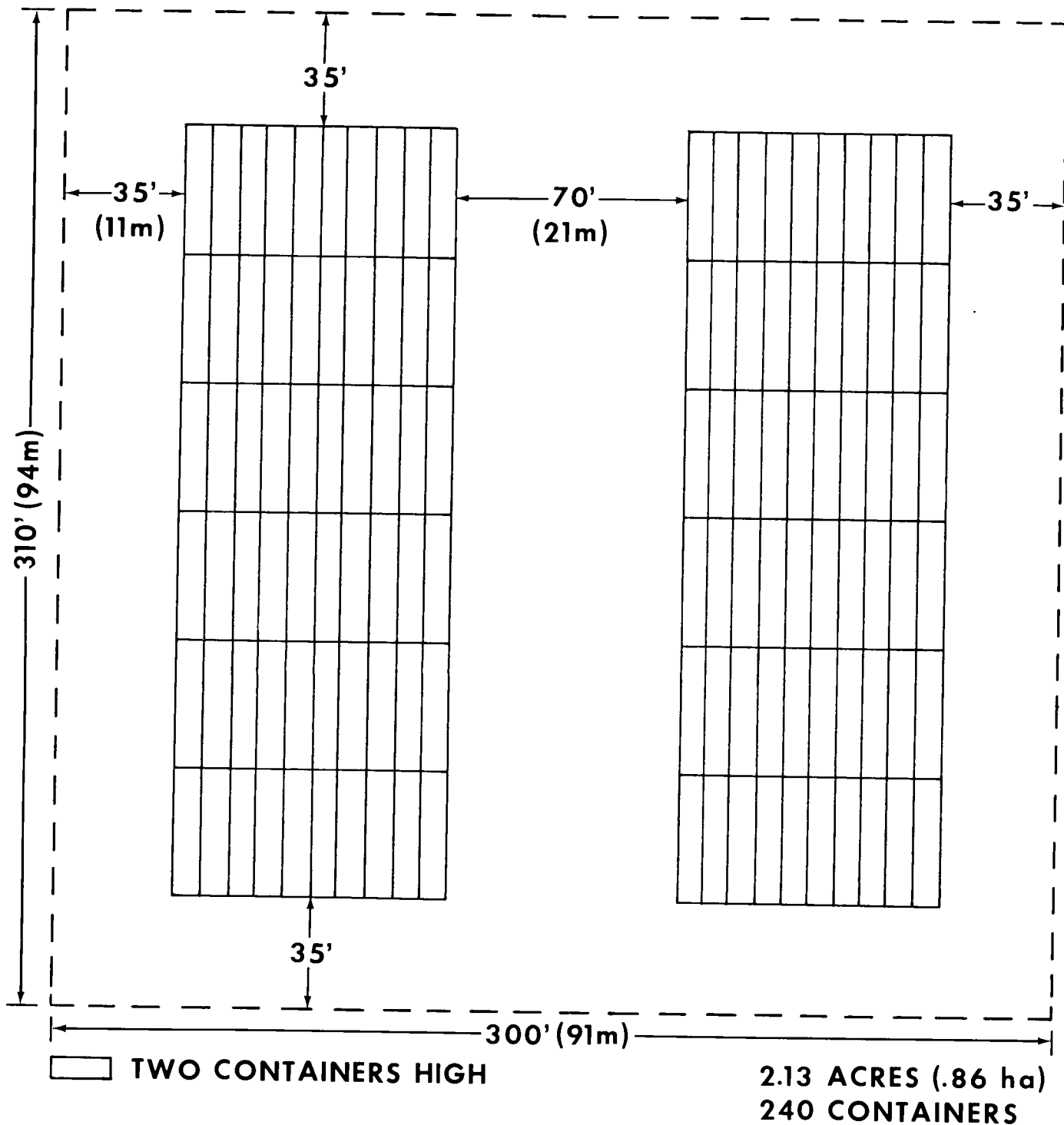


Figure 7-21. Cluster plan for frontloader two-high block stacking of 40-foot containers. This cluster occupies essentially the same space as frontloader turret-stacked 40-foot containers shown in figure 7-11.

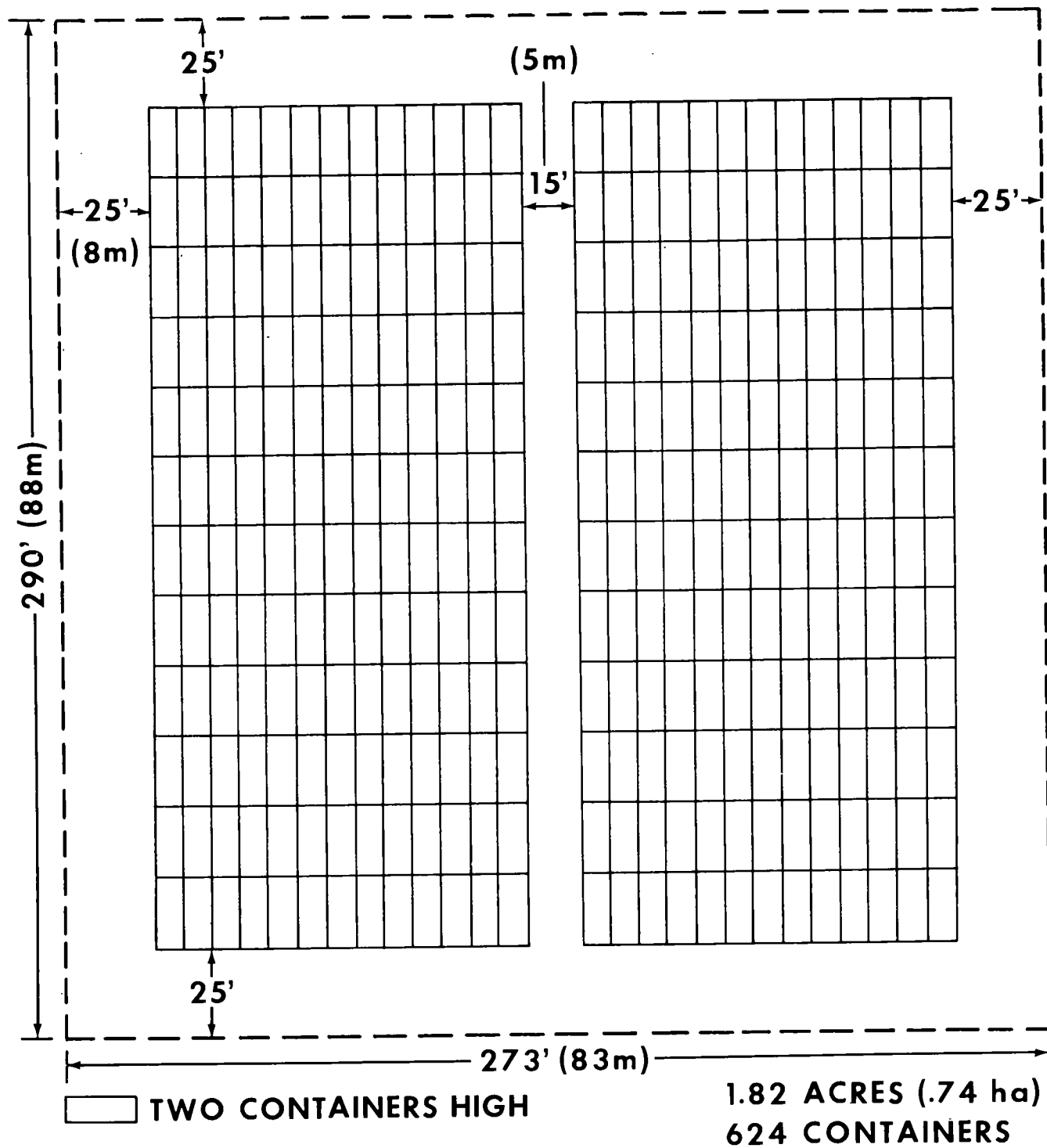


Figure 7-22. Cluster plan for sideloader two-high block stacking of 20-foot containers. This cluster occupies essentially the same space as sideloader turret-stacked 20-foot containers shown in figure 7-13.

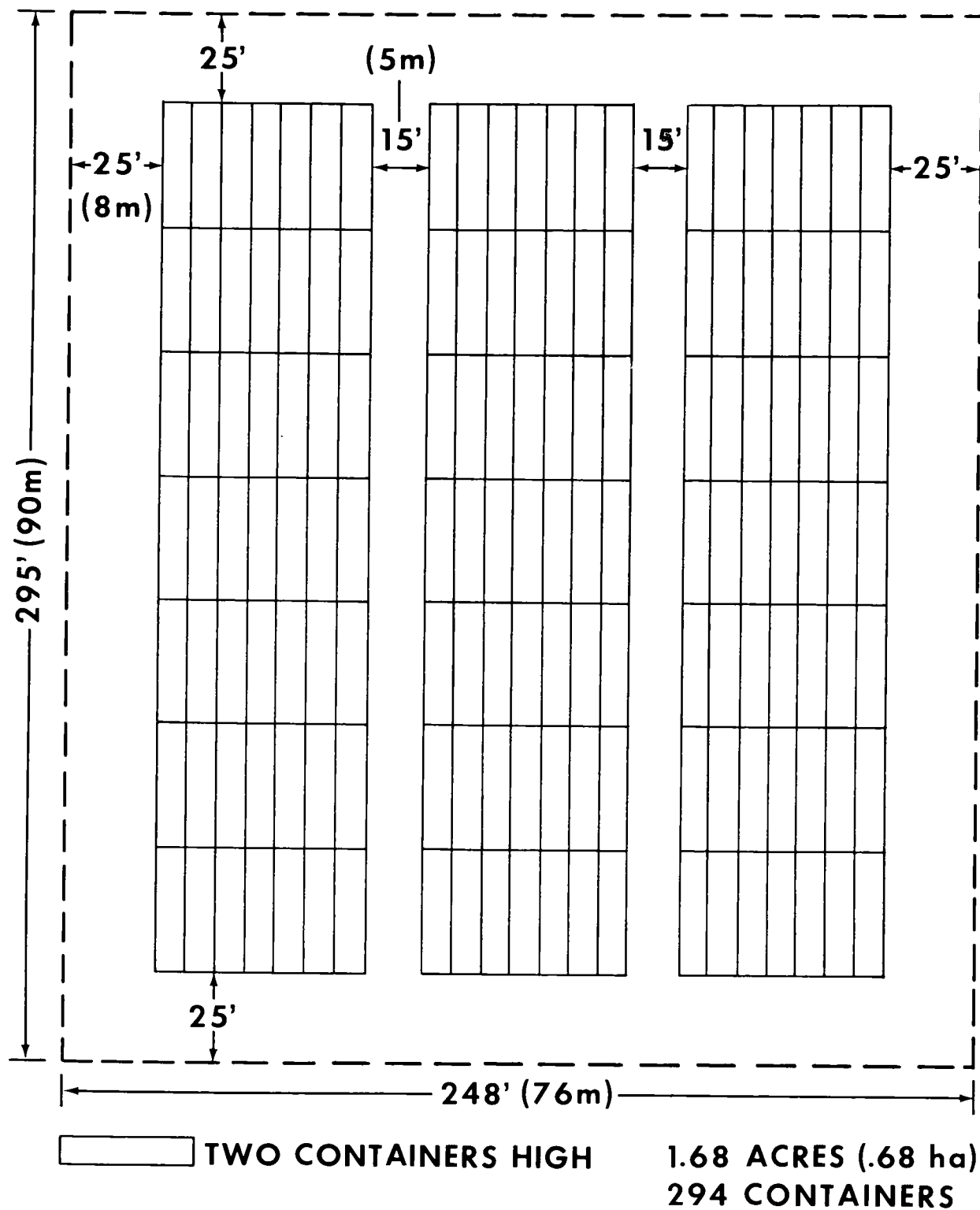


Figure 7-23. Cluster plan for sideloader two-high block stacking of 35-foot containers. This cluster occupies essentially the same space as sideloader turret-stacked 35-foot containers shown in figure 7-15.

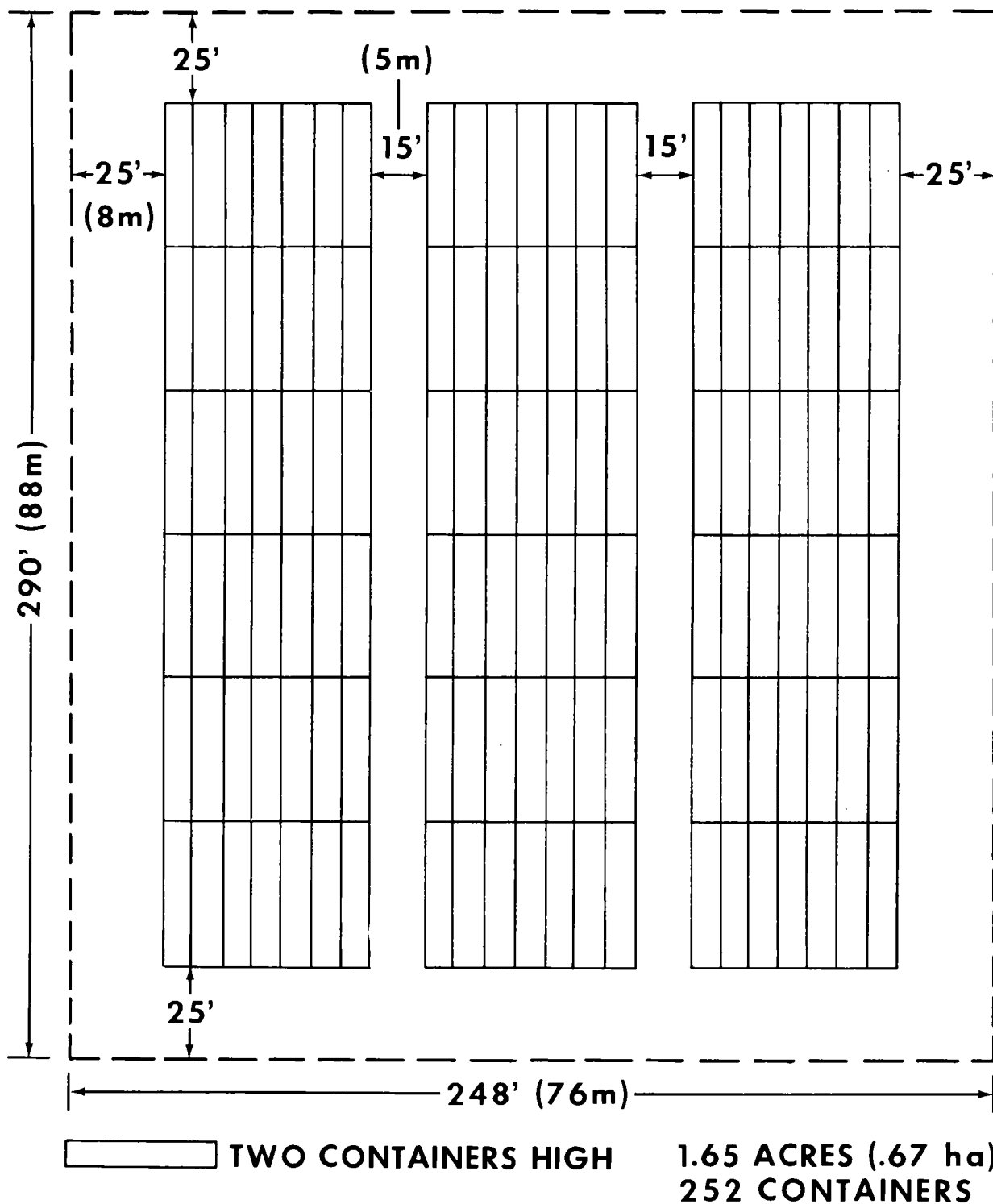


Figure 7-24. Cluster plan for sideloader two-high block stacking of 40-foot containers. This cluster occupies essentially the same space as sideloader turret-stacked 40-foot containers shown in figure 7-17.

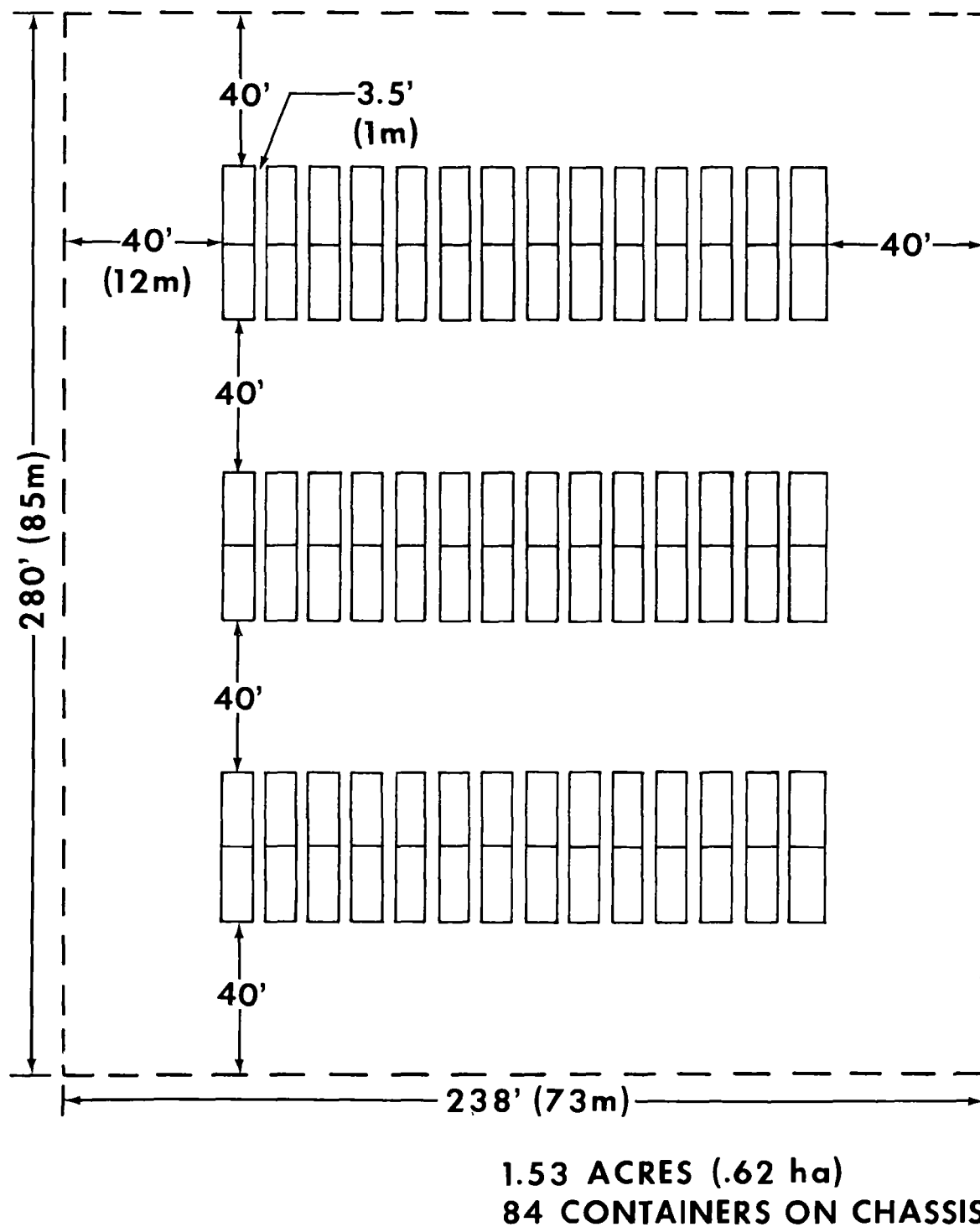
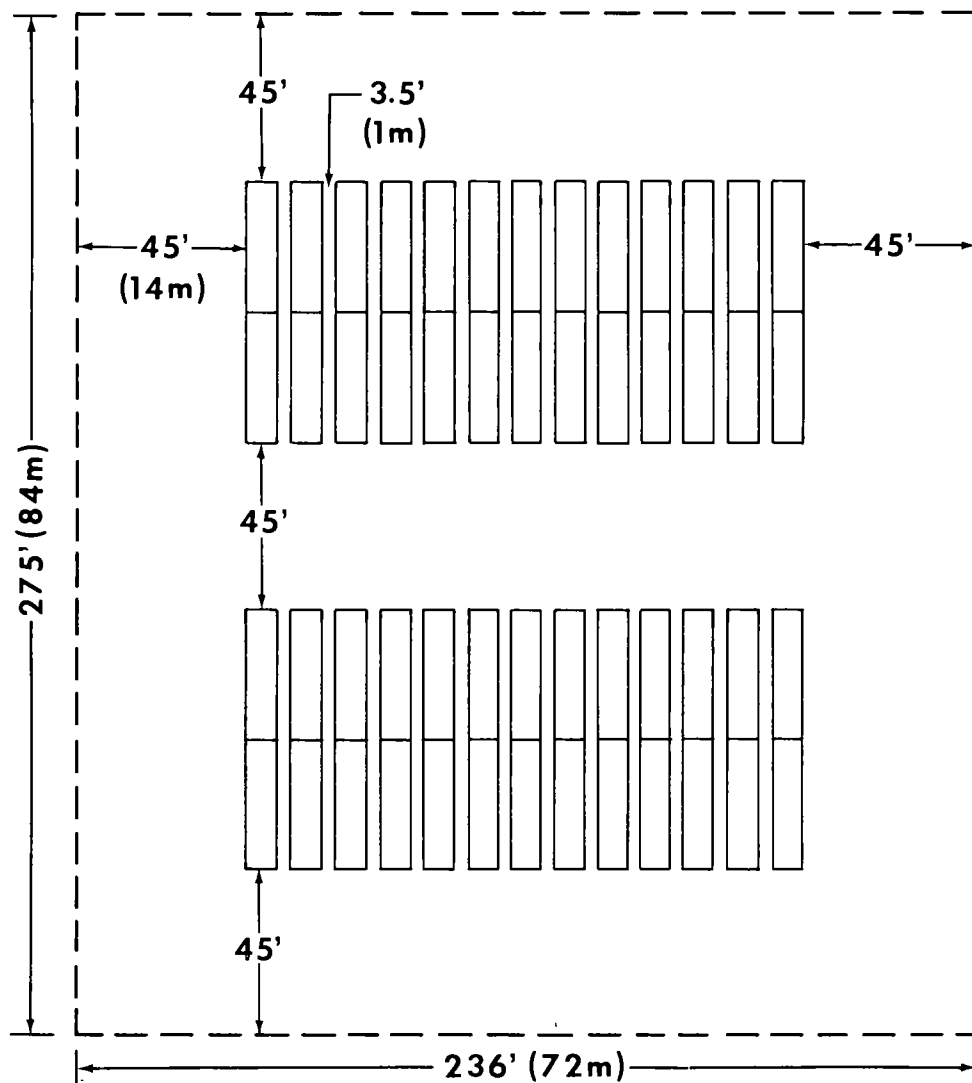
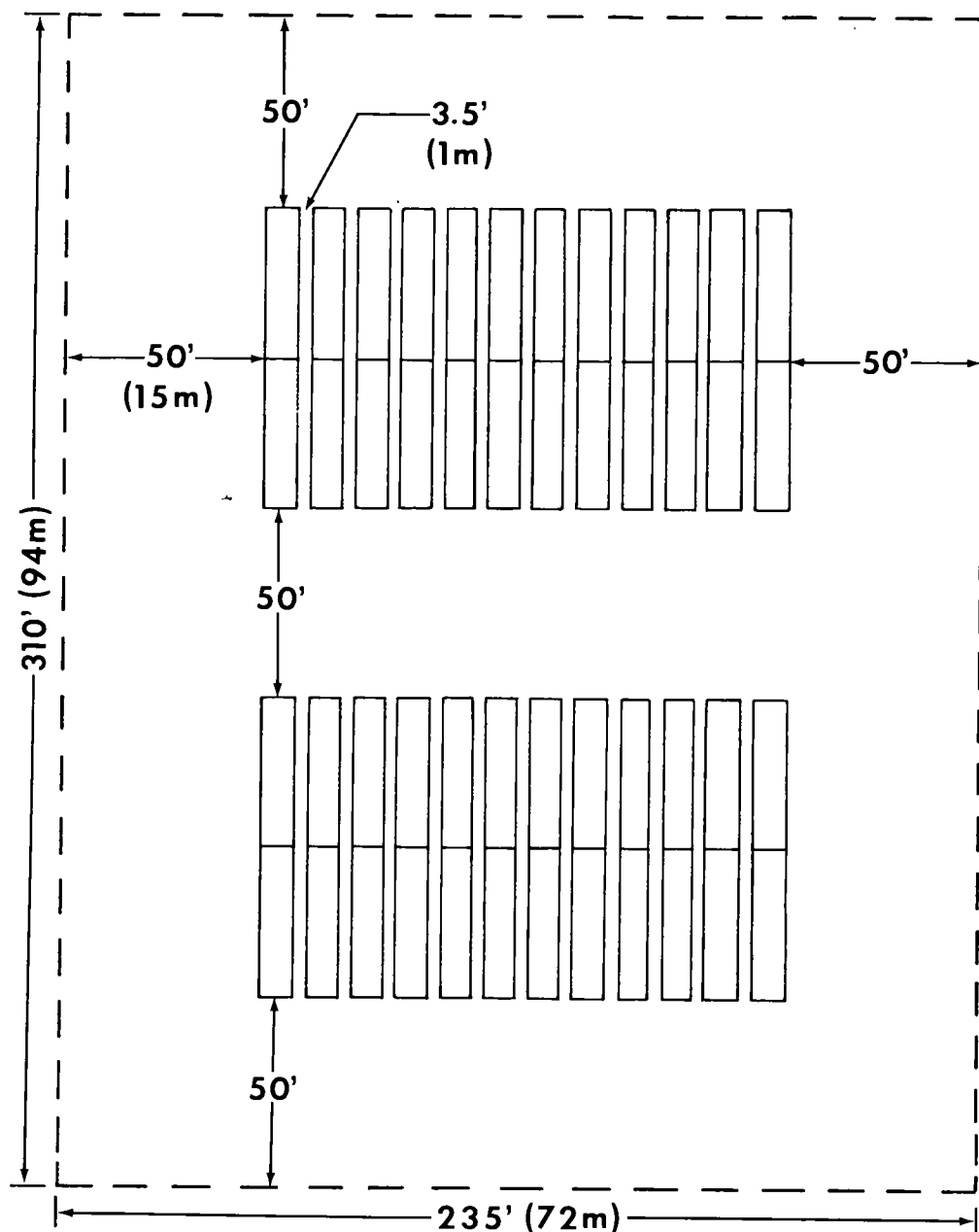


Figure 7-25. Cluster plan for marshaling 20-foot containers on-chassis—40-foot aisles.



1.49 ACRES (.60 ha)
52 CONTAINERS ON CHASSIS

Figure 7-26. Cluster plan for marshaling 35-foot containers on-chassis—45-foot aisles.



1.67 ACRES (.68 ha)
48 CONTAINERS ON CHASSIS

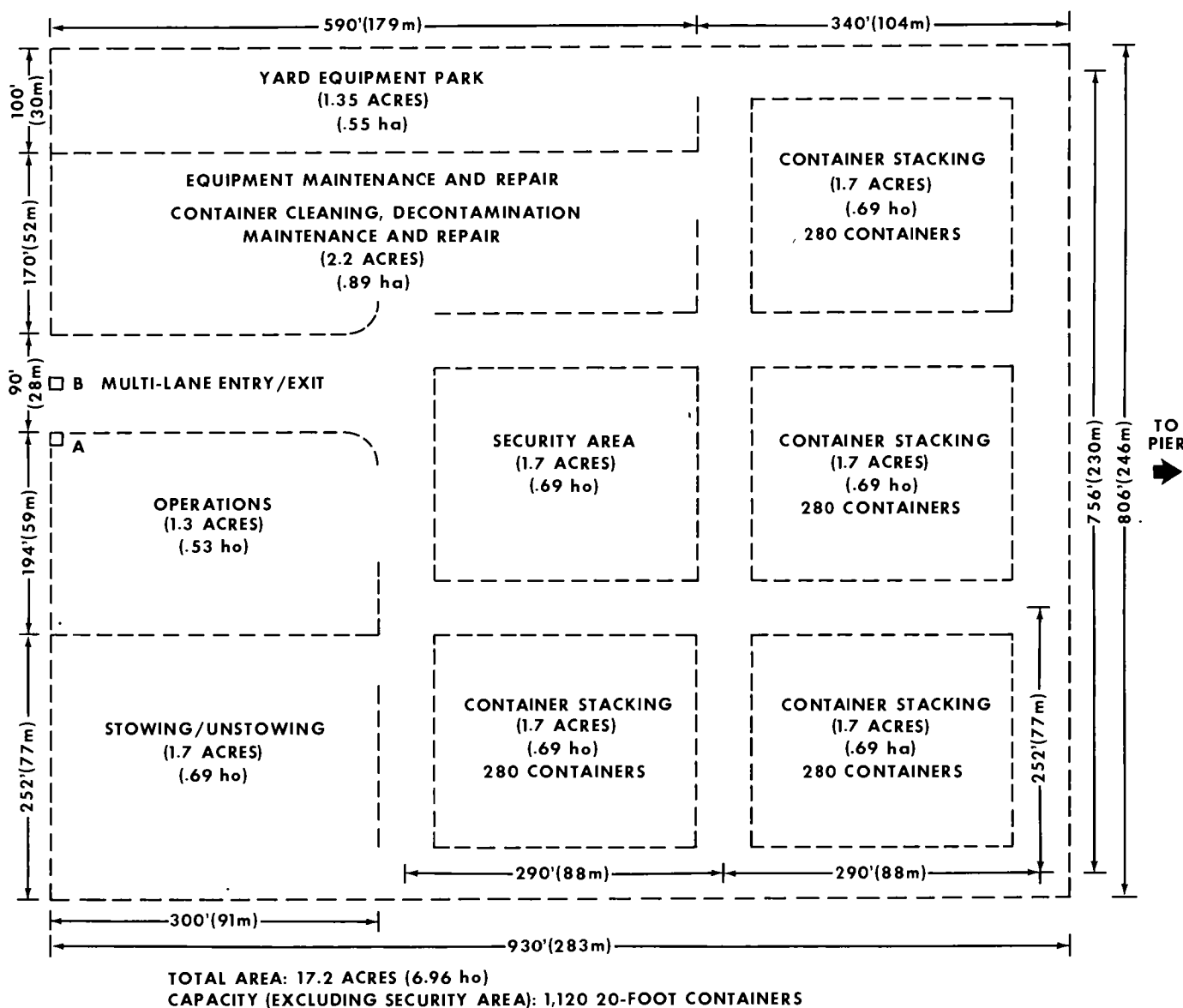
Figure 7-27. Cluster plan for marshaling 40-foot containers on-chassis—50-foot aisles.

Use of the container cluster concept provides a relatively uncomplicated means of developing a marshaling yard commensurate with the requirements of a specific operation or environment. This is

accomplished by grouping clusters within available real estate (modifying cluster dimensions where necessary), and by adding areas to provide the related activities discussed in paragraph 7-1.

Figure 7-28 is a hypothetical marshaling area developed within the cluster grouping concept, and designed to support simultaneous discharge/backload of two container ships in a fixed water terminal operation.

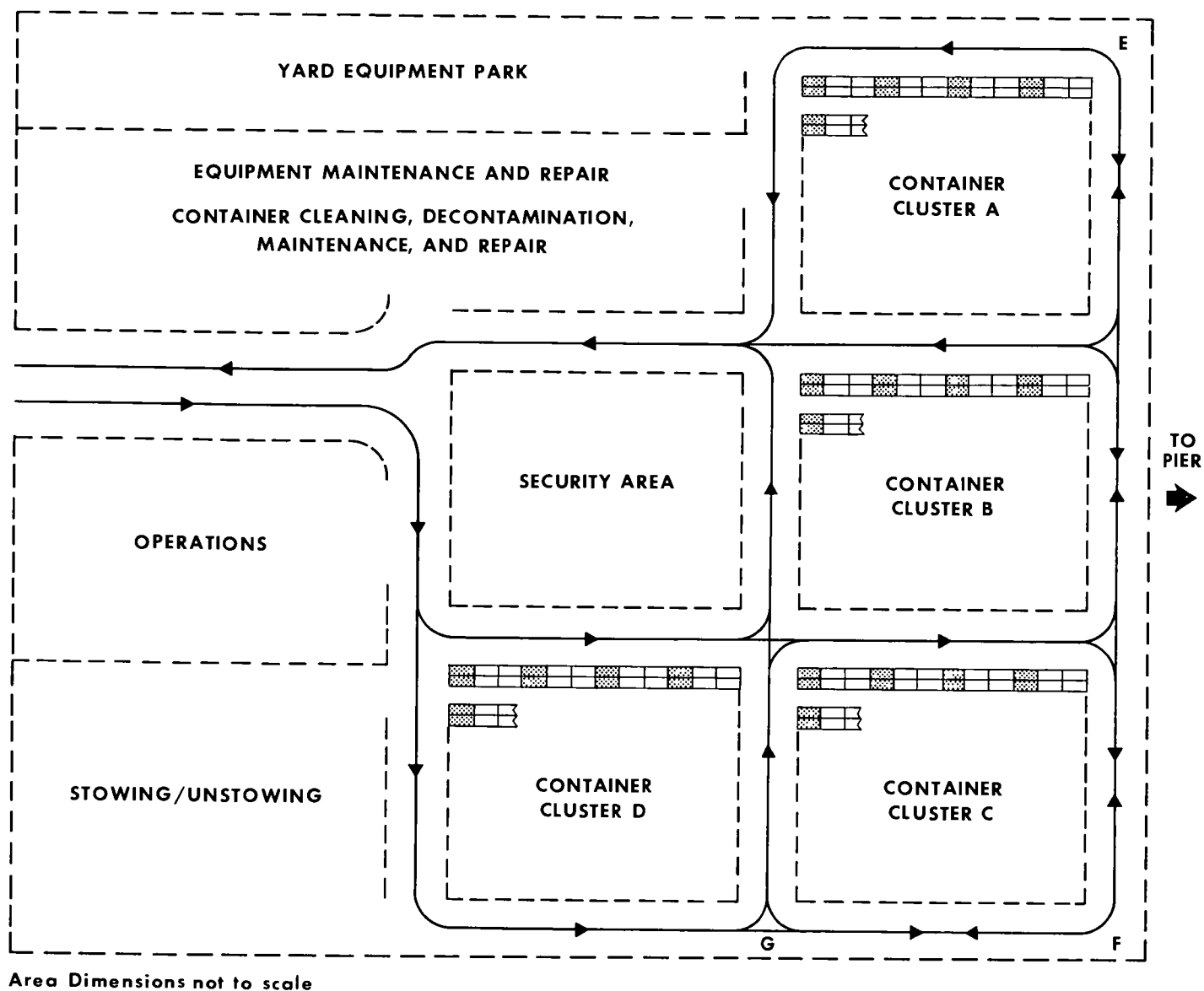
Figure 7-29 illustrates a one-way traffic flow pattern in a container marshaling yard.



Note: Area Dimensions not to scale

- A — Control point for pedestrian traffic. Personnel on foot enter at gate A and are issued color-coded, numbered badges that indicate specific areas of authorization (Area "M" for maintenance, area "O" for operations, etc).
- B — Container control/inspection point (only container transporter/MHE traffic is permitted beyond this point). The transporter driver pulls into parking area adjacent to operations, checks in his TCMD and draws on outbound TCMD. He then deposits his container in a specified location, picks up an outbound container, and departs. The multi-lane entry/exit should provide up to six lanes which may be designated either entry or exit as traffic requires.

Figure 7-28. This hypothetical marshaling area, developed within the container cluster grouping concept, is designed to support simultaneous discharge/backload of two container ships in a fixed water terminal operation. Each ship is worked by one transportation terminal service company. The area provides for sideloader turret stacking of 20-foot containers, using 15-foot working aisles and 50-foot intersecting aisles. The basic cluster plan (fig 7-13) has been modified by eliminating one container ribbon. Two clusters accommodate the discharge/backload operations of one terminal service company. Support areas (operations, maintenance, etc.) are consolidated under battalion control (FM 55-60).



Area Dimensions not to scale

Figure 7-29. Suggested traffic flow in fixed terminal marshaling area. Container clusters A and B support container ship #1. Clusters C and D support container ship #2. In this layout, traffic between points E and F, and points F and G is two-way to permit access of materials handling equipment to cluster working aisles.

Container unload/backload operation.

The container cluster plan (fig 7-13) in this example provides for sideloader turret stacking of 20-foot containers, using 15-foot working aisles and 50-foot intersecting aisles. However, the cluster is modified by eliminating one container ribbon. This changes the cluster dimensions to 290 feet (88 meters) by 252 feet (77 meters) and provides 280 container spaces to the cluster.

For this example, two assumptions are made in computing container space requirements:

- At the start, the marshaling area contains at a minimum, one day's container unload/backload density for each terminal service company. The ratio of inbound/outbound containers will vary, based on

weather, port throughput capability, and vessel arrivals/departures.

- The container unload/backload concept developed in the Army in the Field Container System Study (AFCSS) is accepted; that is—

- The first 30 percent of the unload/backload operation is devoted to unloading.

- The middle 40 percent consists of both loading and unloading.

- The final 30 percent is directed to backloading.

Each container ship is worked by one transportation terminal service company. Operating two 10-hour shifts, with 75-percent availability of equipment, each company can—

- Unload 390 containers and, at the same time, backload 390 containers per day (TOE 55-119T).

This establishes a basic requirement for 390 container spaces per company. However, accepting that the first 30 percent of the operation consists of unloading, and that the marshaling area is full at the start of the day's operation, an additional 117 container spaces are required (390 x .30). Adding this figure to the basic requirement (117+390) results in a minimum requirement of 507 container spaces per terminal service company at the start of the operation. (For planning purposes, it is assumed that for each retrograde container brought into the marshaling area, a full container will be pulled out for onward movement.)

Two clusters are designated for the use of each terminal service company operation. (The security area cluster is excluded from the computations.) This provides each terminal service company with a total of 560 spaces, or 53 spaces more than the minimum requirement. The extra 53 spaces provide a buffer against unforeseeable problems such as a container surge, or a lag in terminal clearance operations.

Note. Using the above procedure, stacks are arranged by vessel, and the in/outbound stacking array can be incorporated into the vessel stacking array. This permits increased control, and better allows for overflow and early arrivals.

Marshaling area clearance operation.

To assure an expeditious and uniform flow of containers from dockside to the hinterland (and vice versa), and to minimize terminal congestion and work stoppages, marshaling area clearance operations are tailored to port unload/backload output. An inbound container should not remain in the marshaling area longer than 24 hours. This also holds true for retrograde containers, provided a container ship is available for backloading.

The normal procedure in clearance operations is to designate specific medium truck units to support a specific container unload/backload operation. In the example discussed here, each terminal service company has its own dedicated container clearance support.

The following discusses motor transport requirements for marshaling area clearance support of one terminal service company operation. In all cases, medium truck units operate around the clock (two shifts) with 75-percent equipment availability (45 semitrailer combinations).

The terminal service company unloads and, at the same time, backloads 390 containers per day (two 10-hour shifts). Ideally, inbound containers should be cleared within 24 hours. If this be the case, a minimum of 390 containers per day must be cleared from the marshaling area. (For planning purposes, it is assumed that for each container moved from the marshaling area, a retrograde container will be returned.)

Applying the medium truck company capabilities set forth in TOE 55-18, clearance requirements are as follows:

- Local haul,¹⁰ using 40-foot container/cargo semitrailer: one medium truck company plus one truck squad (exceed requirements by 30 containers per day).

- Local haul,¹⁰ using 20-foot container/cargo semitrailer: two medium truck companies plus one truck squad.

- Line haul,¹¹ using 40-foot container/cargo semitrailer: two medium truck companies plus one truck squad.

- Line haul,¹¹ using 20-foot container/cargo semitrailer: four medium truck companies plus one truck platoon.

Related support activities.

A headquarters and headquarters company, transportation terminal battalion (TOE 55-116), provides the basic operating headquarters for theater terminal operations, and is the normal command element for each two- to four-ship water terminal (FM 55-60).

Because this is a two-ship operation, a terminal battalion operates the port.

Documentation, inventory, and control functions are consolidated in a battalion operation, supervised by the battalion operations officer. Other functional areas (stowing/unstowing, inspection, maintenance and repair activities, cleaning and decontamination, equipment parking, security) are also consolidated at battalion level and operate under battalion control. This permits the terminal service companies to devote their efforts to container handling.

Note. Until the transportation terminal service company is authorized cleaning and decontamination equipment, it must be obtained through normal supply channels.

Figure 7-30 presents a suggested design for a security storage area in a container marshaling yard.

7-7. Container Marshaling for Rail Movement

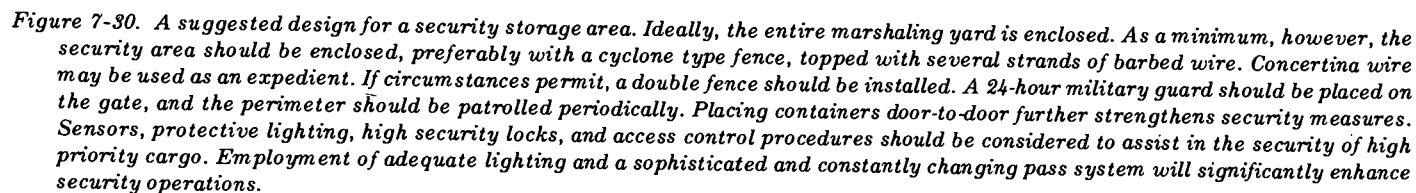
Container movement by rail is used wherever possible because—

- Rail presents a *mass movement capability* with little interference from weather or refugee traffic.
- Rail is the most economical mode.
- The Army family of containers can be moved by rail.

Figure 7-31 presents a procedure for marshaling/loading/unloading containers for rail movement when the rail facilities are not a part of, or adjacent to, the marshaling yard.

¹⁰ For recipients in the theater army area command (TAACOM).

¹¹ These figures can vary, depending upon theater boundary and width.



SIDE VIEW

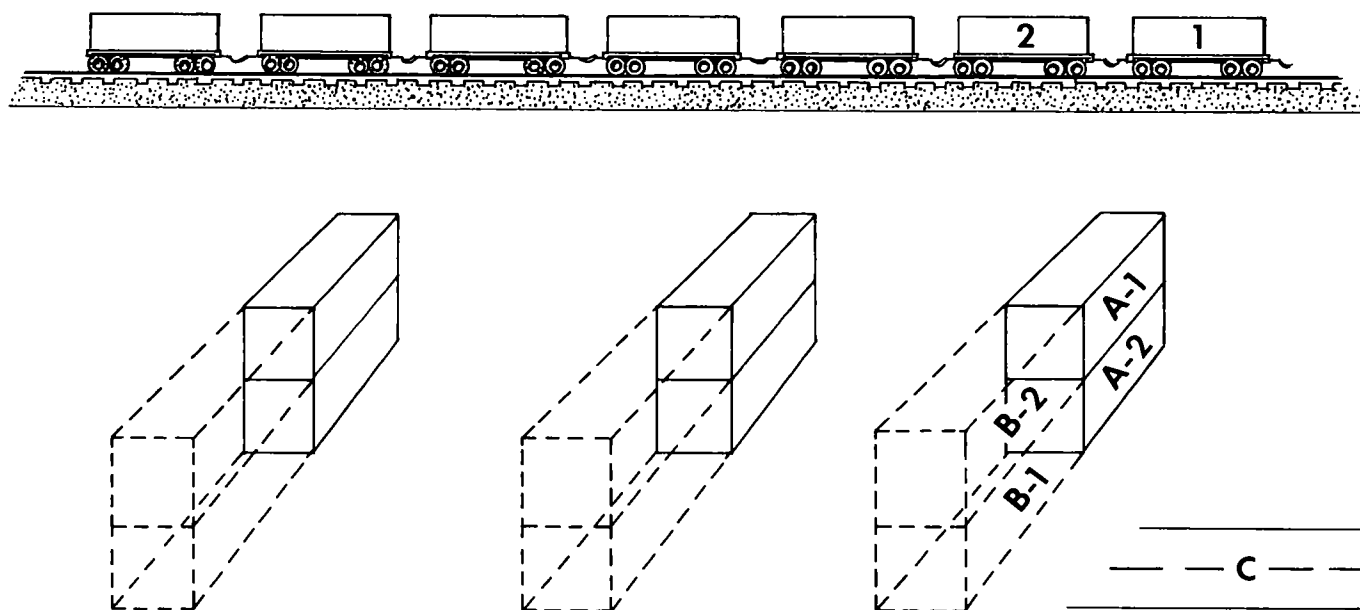


Figure 7-31. A procedure for marshaling/loading/unloading containers for rail movement when rail facilities are not a part of, or adjacent to, the marshaling yard. Here, retrograde containers are being exchanged for loaded containers which will be moved inland. Prior to arrival of the flatcars, loaded containers are moved by truck-transporter to trackside, where they are prestacked two-high as shown. After the flatcars are positioned, loading/unloading proceeds as follows: (1) Remove container 1 to position B-1; (2) Load container A-1 to position 1; (3) Remove container 2 to position B-2; (4) Load container A-2 to position 2; (5) Move to next flatcar and repeat the process. As the procedure continues, gangway C is used to remove retrograde containers to the marshaling yard.

7-8. Army Marshaling Yard Procedures

The commander of an overseas port is responsible, through the operations officer, for operation of the port's container marshaling yard (FM 55-60). The operation may be keyed to automated documentation procedures or, if automated data processing equipment is not available, to manual procedures.

The Army has developed an automated documentation system, *Department of the Army Standard Port System (DASPS)*—¹²

- This system currently has been implemented in five major overseas water terminals.

- Currently programed testing may prove that DASPS, through the use of land lines or TELEX connecting with mobile remote terminal facilities, can extend its central data bank services to other ports or to LOTS sites.

DASPS is a computer system that processes both magnetic tape and punchcard. The basic input media to DASPS is punchcard. The system—

- Satisfies cargo accounting, documentation, and manifesting requirements (for import and export cargo).

- Satisfies other related functions of the water terminals.

- Meets the input/output requirements of DOD Regulation 4500.32-R.

Import cargo. For import cargo, the shipping port transceives an advance manifest to the receiving port (theater of operations). Upon receipt of the advance manifest, the receiving port establishes files to be used in processing for preparation of documentation to include—

- Hatch summaries/parking instructions.
- Port cargo clearance plans (PCCP).
- Cargo disposition instructions (CDI).
- Transportation control and movement documents (TCMD).

Hatch summaries, preprinted from the advance manifest, provide the operator with advance notice of—

- Types (cargo, refrigerated, etc.) by size and quantity of incoming containers.
- Movement priorities.
- Ultimate destination.

The above information (in conjunction with the PCCP) permits the operations officer to preplan marshaling yard space requirements, and to predetermine where each offloaded container will be stacked in the yard. This is particularly important in the planning of onward movement of outsize and/or overweight cargo.

Figure 7-32 illustrates a system for identifying

¹² Volumes I and II, FM 55-64 (Test), discuss DASPS in detail. Discussion in this chapter is directed primarily to application of DASPS to container marshaling yard operational procedures.

containers by number and location within the marshaling yard.

With the planned stack location of the container known, the cargo checker can be given a printout for those containers he will be tallying. Using this, he can, as containers are unloaded from the ship, direct the yard transporter to the designated stacking area. Radio communication between the cargo checker and marshaling yard operations is the only way to insure adequate control of the operation—especially in a large yard or in a highly fluid situation.

If computer equipment is not available, a visual display board of the stacking area can be maintained by operations to provide container identification and location. A manual system requires appropriate internal communications.

Cargo disposition instructions. The CDI is used as a consignee advance notification document. Based upon the CDI, the port's servicing transportation movement officer (TMO)—

- Coordinates with the transportation movement office (TMO) serving the consignee to—
 - Assure that the consignee can receive the shipment.
 - Arrange delivery dates.
- Arranges for transportation to move containers from the marshaling area to final destination for—

—A commercial contract operation by going direct to the commercial operator.

—A military movement by going to the TMO that has authority to commit resources of the appropriate transportation mode.

Retrograde movement. When a retrograde container enters the marshaling yard, the container transporter driver presents the TCMD at the entry point and has the container inspected. He is then given a receipted copy of the TCMD (as proof that he has delivered the container) and directed to the point where the container is to be unloaded. (He is also given a TCMD for the container that he will pick up for movement out of the yard.)

The TCMD for the retrograde container is entered by punchcard into the central processing unit which then produces a "prepunched card packet" for the receipt, release, and loading of the container for export. Subsequently, as each event occurs (receipt, release, load), the appropriate card is annotated and entered into the central processing unit. The container location designator (derived as for import containers) is also entered into the central processing unit and becomes a part of the marshaling yard computerized container inventory.

Transportation control and movement document (TCMD). A TCMD is required each time cargo is moved from the area of responsibility of one indi-

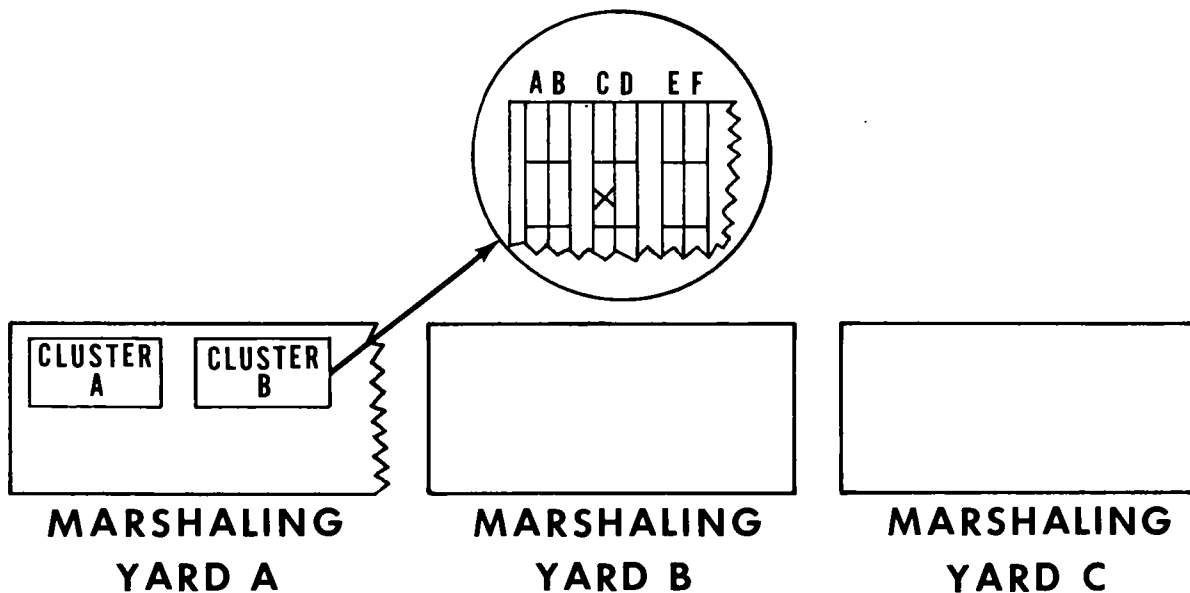


Figure 7-32. A computerizable system for container identification by row location within the marshaling yard. In the above, the marshaling yard is lettered, as are the container clusters (fig 7-7-7-24); within each cluster, the rows are lettered. The marshaling yard designator, the cluster designator, and the row designator are combined to form a three-character alpha designator acceptable to the data processing system. Thus, container X above acquires the designator of A-B-C, meaning that it is in row C of cluster B of marshaling yard A. This designator may be cardpunched and entered in the tape of the central processing unit. Marrying-up in the computer memory of each container number with its location designator provides a computerized container yard inventory. When a container moves out of the yard, or is relocated within the yard, this change is entered in the central processing unit by punchcard, thereby keeping the inventory current. The computerized inventory should be verified daily by a physical inventory. If desired, the computerized inventory may be backed up by a locally fabricated visual display board.

dual or activity to another (FM 55-11).

- A TCMD is prepared for each container moved from the marshaling yard to consignee. Under DASPS, the TCMD is, upon request by the user, preprinted by the central processing unit. (Without computer equipment, the TCMD is prepared manually.) Among other information, the TCMD shows the container number, the container transporter number, and the container seal number.

- No container can be moved out of the marshaling yard exit/entry point without proper documentation and inspection. The container number, the container transporter number, and the container seal number all must agree with those shown on the TCMD. If not, the container does not go until proper documentation is prepared. When the container departs the marshaling yard, a copy of the TCMD is retained for entry into the central processing unit to show that the container has been shipped to consignee and to update the computerized marshaling yard inventory.

Customs documentation. Under DASPS, customs documentation (when required) is preprinted by the central processing unit upon request. (When computer equipment is not required or available, customs documentation is prepared manually.)

Container scanning device. The Army is currently testing a portable scanning device that, among other things, should improve in-transit cargo visibility and significantly reduce the requirement for manual preparation of input data in punchcard form. Scanning is done by using—

- Special electronic labels that are affixed to the container and, for highway movement, to the container transporter.

- The portable scanner, which can be placed in operation by one person, reads the label(s) at distances up to 20 feet, and speeds up to 85 miles per hour. The resultant data is fed into the appropriate central processing unit.

Use of the container scanning device in the theater movement management system is discussed in chapter 11 of this manual.

In management and control of the marshaling yard, the scanner would be linked with the DASPS central processing unit through a land line, or (if land line is unsuited) by way of audio coupler to a transceiver with radio link to the terminal.

The portable container scanning device is used in the marshaling yard as an inventory management tool, providing input data to the DASPS central processing unit for the following:

- *Containers unloaded from or loaded on ocean transport.* Some means of accurately identifying the loading of each specific container on board ship in a specific stowage location is required. The same specific identification of a discharged container is

required. Electronic scanners have been used with varying degrees of accuracy, but it appears that the commercial operators may adopt a method whereby a digital report will be punched into a portable device connected by a wire to the terminal's data processing unit.

- *Containers unloaded from or loaded on rail transport.* These containers are handled essentially as for ocean transport.

- *Containers entering or leaving the marshaling yard by motor transport.* Two scanning devices are required at the yard entry/exit point—one for incoming traffic, and one for outgoing. The scanner reads the electronic label on both the container and the transporter and transmits the information to the central processing unit for storage and for updating the computerized yard inventory.

- *Yard inventory.* The scanning device may be mounted on a light vehicle to make the device mobile. It can then be driven through the stacking area to read container labels for verification of the computerized inventory. Any discrepancies in the inventory are then verified by physical inventory.

7-9. Marshaling Yard Security

Reduction of cargo theft and pilferage is regarded as one of the more significant benefits of containerization and, compared with losses suffered in break-bulk operations, the reduction is indeed noteworthy. Nonetheless, losses under containerization are growing—so much so that they have become of major concern to industry and to Government alike.

Appendix C to this manual discusses overall security in broad terms. This paragraph is slanted toward marshaling yard operations, and is more detailed. Perhaps the importance of this area is best illustrated by the recent observation of an authority on transportation security. Speaking of commercial operations in the continental United States (CONUS), he stated:

"Eighty-five percent of stolen cargo goes out the front gate of transportation facilities, during normal working hours, in the possession of persons, or on vehicles, authorized to be on the premises."

Control of inbound/outbound traffic. From the above, strict control of ingoing and outgoing traffic is obviously a key factor in marshaling yard security. Basic to this control is—

- Restriction of vehicular traffic entering/exiting the container stacking area to container transport equipment, materials handling equipment, and mobile scanning equipment.

- Establishment of a single control point (gate) for vehicular traffic entering/exiting the container stacking area. This point is manned and operated by US military personnel assisted, as necessary, by foreign national police and/or interpreters.

- Establishment of a separate gate for pedestrian traffic. This point is operated by military police (MP) ¹³ assisted, as necessary, by foreign national police and/or interpreters.

Surveillance and control functions of the vehicular control point include—

- Preventing entry of unauthorized vehicles.
- Inspecting inbound outbound containers. This is a thorough physical inspection to include container condition; presence and condition of container seal and/or lock; evidence of illegal entry (such as by tampering with or removal of door hinges); and, particularly for outbound containers, stolen items (look on top of and under container, and inspect transporter cab).

- Verifying documentation for correctness, completeness, and legibility (check that transporter number, container number, and container seal number match those shown on TCMD).

- Operating scanning equipment (para 7-8). (If there is no scanning capability, container numbers are reported manually to operations so that the yard inventory may be updated.)

- For outbound containers, entering departure time and date on the TCMD, and retaining copy for terminal files.

- For inbound containers, signing one copy of the TCMD for retention by transporter operator as a delivery receipt.

Surveillance and control functions of the pedestrian control point include—

- Permitting only authorized personnel to enter container marshaling area (primarily concerns foreign national contract operators and other indigenous personnel).

- Maintaining, controlling, and safeguarding the pass system for foreign national personnel authorized to be in the area.

—A photo-bearing, serially numbered, plastic-enclosed pass is prepared for each foreign national working in the yard. The individual picks up his pass when he enters through the gate and returns it to the security guard upon leaving.

—A further refinement of the pass system may be made by color-coding to indicate the specific area of the yard in which the bearer is authorized. Color-coding can be made even more visible by requiring hard hats that reflect the same color as the pass.

Perimeter security. Security of the marshaling yard perimeter backs up gate security in keeping unauthorized people out of the area. Such people may engage in sabotage (particularly in an ammunition marshaling area) or petty theft or, to promote large scale theft operations, establish inside con-

tacts with foreign nationals or other people working in the yard. Perimeter defense measures may include one or a combination of the following:

- Chain type fencing topped by three strands of barbed wire. (Inspect fence daily to assure there are no holes or breaks.)

- Concertina wire.

- When feasible, use of a sensor.

- In a LOTS operation, mined strips on the land side.

- Use of patrols as discussed in appendix C.

While it may not be possible to fence the entire yard perimeter, the security (that is, sensitive, classified high-dollar value cargo) area should, as an absolute minimum, be fenced with its own military-guarded gate and MP patrol.

Container transporter operator. Drivers of line-haul and local-haul container transporters are required to remain in the cab of their truck when operating within the container stacking area.

Security cargo. As noted above, security cargo should be stored separately from other cargo, and should have its own secured area.

Additionally, whenever possible, security cargo should be unloaded from the ship during daylight hours. Observation of unloading operations by MP security personnel is highly desirable.

Transportation control and movement document (TCMD). No container moves through the marshaling yard entry/exit (control) point without a valid and legible TCMD.

- When the TMO determines that a container is to be forwarded to the consignee, the TMO informs the documentation section and the control point giving them the date of the movement, the container number, and the consignee.

- The documentation section then prepares the TCMD and informs the TMO and the control point of the actions, giving them the container number, the transportation control number (TCN), and the transporter number.

The above coordinating procedures serve to prevent removal of containerized cargo from the yard, either accidentally or purposely.

At the gate, the container number is verified against the information provided by the movement and the documentation sections; container number, seal number, and transporter number are verified for agreement with those entered on the TCMD; the container seal is examined for breakage or evidence of tampering. Finally, before the container is released, it is inspected for evidence of damage (climb up on top of it—look it over thoroughly).

When the control people release the container, they notify the TMO who in turn notifies the consignee TMO that shipment has been made.

Retrograde containers must also be accompanied

¹³ MP support for the marshaling area is not automatic, but must be requested.

by a TCMD. After control people verify TCMD entries (container number, seal number, etc.), and inspect the container, they give the driver a receipted copy of the TCMD, and directions to where the container is to be unloaded.

As discussed in paragraph 7-8, scanners on the inbound and outbound lanes transmit the container number to a central data bank for updating the yard inventory.

Verification of container arrival at destination. Upon receipt of the container, the consignee returns a copy of the TCMD to the shipping terminal activity with consignee signature, day of receipt, and condition of cargo, container, and seal.

Safeguarding and controlling TCMD. Normally TCMD are not accountable documents. However, local procedures may call for numbering TCMD serially. This is an excellent procedure to deter their use in organized thievery. Regardless, blank TCMD should be secured, with one individual responsible for their safeguarding and issue.

Safeguarding and controlling container seals. A container seal is a device applied to the container door fastening to indicate whether the door has been opened or the fastening tampered with and, if so, at what point in the movement system it happened.

Seals are serially numbered to help identify the person who applied the seal, and to provide a means of control. Unless seals are strictly accounted for from receipt to application, their purpose (to pinpoint unauthorized entry into the container) is defeated. Container seal control and accountability is promoted by the following procedures:

- Maintain a record by serial number of seals—
 - Received by the port operations officer.
 - Issued to authorized personnel for application to containers.
- Store seals under lock.
- Designate one person to be responsible for the safekeeping, issuance, and record keeping of seals applied at the port.
- Designate specific persons on each shift to apply seals (keep number of persons to a minimum).
- Enter serial number of seal on TCMD.
- Conduct periodic inventory of seals.

Seals should be applied—

- As soon as a container has been stuffed.
- As soon as a loaded unsealed or improperly sealed container is detected.

Application of seals should be supervised. Failure to supervise, or allowing a yard hostler to move an unsealed container to the stacking area offers opportunity to—

- Pilfer cargo prior to applying the seal.
- Apply a bogus seal, break the seal later, remove cargo, and then apply the legitimate seal.

7-10. Summary

The container marshaling yard is an area in a water terminal used for temporary in-transit storage and processing of inbound and outbound containers. In-transit storage is held to a minimum, with containers being cleared as rapidly as possible.

In addition to in-transit storage, services of the marshaling yard normally include—

- Container repair.
- Container stowing/unstowing.
- Container documentation.
- Container cleaning and decontamination.
- Organizational maintenance of yard equipment.

The marshaling yard should be located as near the container loading/unloading site as possible, with ready access to primary lines of communication. It should be level and well drained, and the surface should be capable of supporting containers stacked two-high. Surface support requirement is a particular problem in a LOTS operation, and will usually require engineer support.

Containers may be placed in the marshaling area either on-chassis or off-chassis.

In off-chassis stacking, the number of containers that can be accommodated per acre of space varies with container length, width of aisles, type of materials handling equipment used, and stacking configuration (fig 7-7—7-28).

Primary configurations of off-chassis stacking include—

- Ribbon stacking—may be used when there is no requirement for selective extraction of containers from the stack.
- Block stacking—used when containers have a common destination or when, for other reasons, there is no requirement for selective extraction of containers from the stack—particularly suited to stacking retrograde containers or empties.
- Turret stacking—of the three configurations, this is the least economical of space. However, it requires less handling for selective extraction of containers from the stack than do the other two configurations. It greatly enhances the marshaling yard's throughput or retrograde operations because it is the fastest and most responsive.

The Army has developed an automated documentation system, DASPS, which is currently implemented in five major oversea water terminals. DASPS is a computer system that processes both magnetic tape and punchcard. The system satisfies cargo accounting, documentation, manifesting requirements, and related functions for import and export cargo. When used in conjunction with a container scanning device under development by the Army, it will, among other things, provide a fully automated system for container marshaling yard documentation and inventory functions.

Although containerization in comparison with break-bulk operations has greatly reduced cargo pilferage and theft, containerization losses are increasing at an alarming rate and much of it is suffered during various phases of marshaling operations. For this reason, every possible method must be implemented to detect and prevent theft from the marshaling area. Primary means of reducing losses include—

- Constant indoctrination of personnel in security measures.
- Strict gate control for vehicles and personnel.

- Physical security measures, such as perimeter fencing, guards, patrols, secured area for sensitive cargo, etc.

- Military control of marshaling yard passes, TC-MD, container seals, etc.

- Periodic inspections and searches for evidence of loss, possible problem areas, and slackness in security measures.

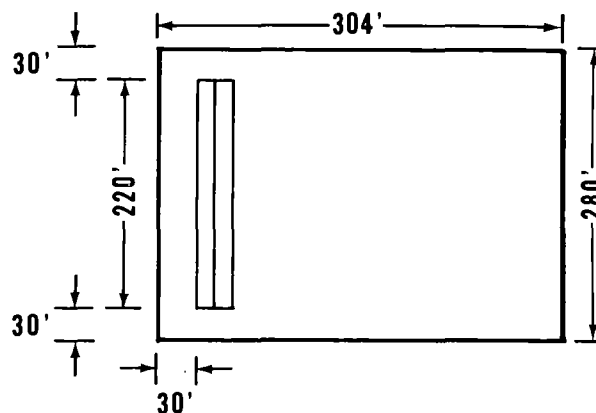
- Complete coordination between movement personnel, documentation personnel, and gate control personnel in identifying each container cleared from the marshaling area.

SAMPLE PROBLEM FOR COMPUTING CONTAINER SPACE REQUIREMENTS IN A MARSHALING AREA

Lieutenant Jones has been assigned the mission of running a marshaling yard for a portion of the logistics over-the-shore (LOTS) operation of the 999th Transportation Terminal Service (TS) Company. Dimensions of the assigned area are 304 feet by 280 feet. The lieutenant must maintain the capability of selectively extracting containers as required by transportation movement office (TMO) operations. Frontloader operators are relatively inexperienced, and the company commander has directed that operators be given an extra 15-foot allowance on turning radius, 30 feet at the ends of each double row of containers, and 30 feet between the boundaries and container rows. How many 8x8x20-foot containers will Lieutenant Jones be capable of stacking, using a cluster plan for stacking the containers?

Step 1: Lay out a plan of the area.

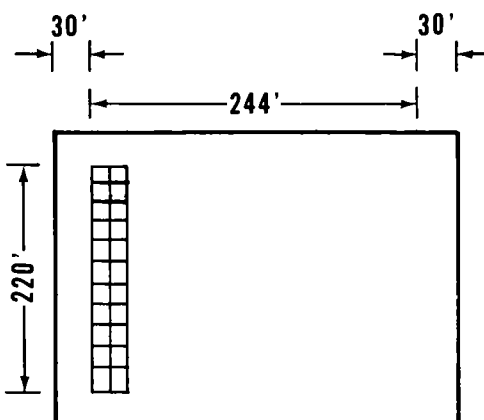
- a. Draw rectangle representing the area.
- b. Mark off 30 feet on all sides.
- c. Mark off a representative double row of containers with the outside border 30 feet from boundary.



Step 2: Determine number of containers in one double row. Since containers occupy 8 feet by 20 feet of ground space, divide 20 feet into 280 feet - 2 (30 feet) = 220 feet (length in which containers will be placed).

$$220 \div 20 = 11 \text{ containers} \times 2 = 22 \text{ in one double row.}$$

Step 3: Determine number of double rows which will fit in allocated space.



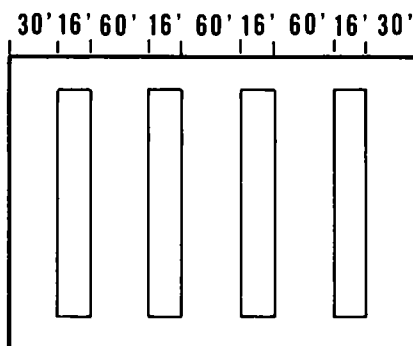
- Determine total distance allocated. $304 \text{ feet} - 2 (30 \text{ feet}) = 244 \text{ feet}$.
- Determine total number of 60-foot lengths (working space of frontloader as modified by company commander) in 244 feet.

$$244 \div 60 = 4 \text{ with a remainder of } 4 \text{ feet.}$$

- Determine width of double rows of containers.

1 double row of 8x8x20-foot containers is $8 \times 2 = 16 \text{ feet wide}$.

- Since each row *must* be 16 feet wide, and the previously determined four working spaces did not consider width of each double row, then the total exact number of working spaces between container double rows must be less.



- Try three working aisles and four double rows of containers.

$$30 + 16 + 60 + 16 + 60 + 16 + 60 + 16 + 30 = 304 \text{ feet;}$$

therefore, four rows of containers.

Step 4: Determine final number of containers the yard can contain.

- If each double row of containers contains 22, then four double rows will contain *88 containers*.
- Since selectivity must be maintained, Lieutenant Jones will maintain capability to extract a given container with a minimum number of container moves. Therefore, use is made of the *turret method* of stacking which leaves one in three spaces blank. One single row of containers = 11. $11 \div 3 = 3R2$ which means that three containers must be subtracted from each row of 11. $11 - 3 = 8$ containers on each row in the second tier. Eight single rows. $8 \times 8 = 64$ in second tier.

- 88 containers in first tier + 64 in second tier = *152 containers* in yard.

Refer to figure 7-8 for cluster plan for frontloader turret stacking of 20-foot containers—60-foot aisles.

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CHAPTER 8

UNIT MOVES

8-1. Background

During the buildup phase of the Southeast Asian conflict, the container express (CONEX) was used extensively to containerize accompanying unit equipment and supplies for overseas movement. Specifically, during the period 1966 through 1968, a total of 21,039 CONEX containers was used in connection with unit deployments and, had the containers been available, the number would have been even greater.¹

To illustrate the potential impact of containerization on troop movement and logistic support in Southeast Asia, it has been calculated that, if *maximum containerization had been employed during the period 1965 to 1968, over \$880,000,000 (including 33,000,000 man-hours) would have been saved* in the areas of transportation, cargo handling, port facilities, shore facilities, and ship delays. Deep draft berth requirement would have been reduced by more than 50 percent. Of perhaps even greater significance, the troop deployment rate could

have been increased by approximately 60 percent, thereby effecting troop buildup in less than half the time that was required.

Recent study findings concerning the use of containers and container ships in unit deployment have further substantiated the feasibility and desirability of containerizing unit equipment and supplies for overseas movement by ship.²

8-2. Ship Utilization

Containerized unit deployment requires a mix of ship types for optimum ship utilization. Container ships are used to transport containerized unit equipment and accompanying supplies and to transport organic vehicles that can be carried on the flatrack container. Container ships are also used to transport containerized ammunition.³

Roll-on/roll-off (RORO) vessels are used for wheel and track vehicles that, because of their size or weight, cannot be transported on flatrack containers. Barge-carrying ships (lighter aboard ship (LASH) and the sea barge (SEABEE)) are used to transport other items of equipment not containerizable because of size or weight.

¹ Monograph 7, Containerization, Logistic Support in the Vietnam Era, A Report by the Joint Logistics Review Board.

² USATEA Report 71-15, Unit Deployment by Container/Containership, USA Transportation Engineering Agency, May 1971.

³ Ammunition is transported separately by specially designated ammunition ships in 8x8x20-foot containers having special internal restraint systems (chap 2).

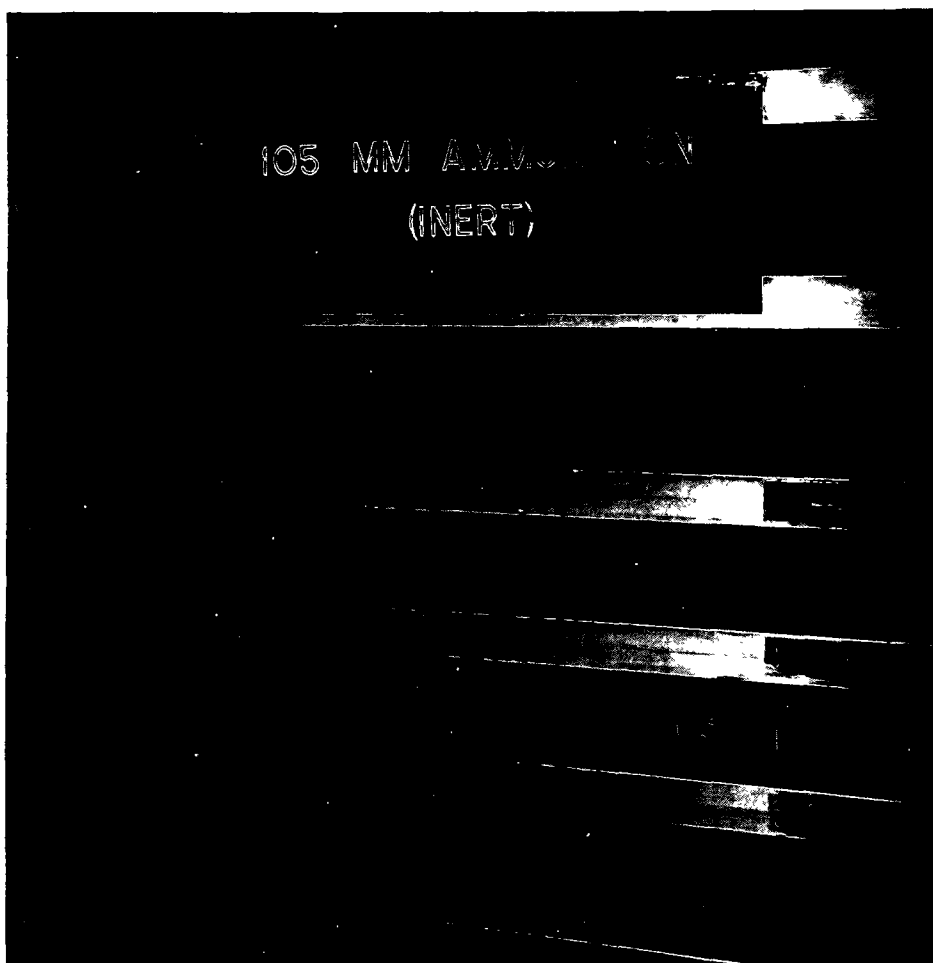


Figure 8-1. Ammunition stowed in the 20-foot MILVAN container for movement overseas. Ammunition can be expected to weigh out before it cubes out. Cargo is restrained by the internal mechanical bracing system, designed specifically to convert the MILVAN for carrying ammunition. (US Army photograph.)

Unit integrity is achieved by loading containerizable cargo of battalion and smaller sized units on the same container ship and by loading all the noncontainerizable equipment on the same RORO or barge-carrying ship. Since many small units—particularly combat support and combat service support elements—have small quantities of equipment, the equipment and supplies of several small units can often be loaded on a single ship.

The greater cube capacity of modern ocean ships combined with their increased turnaround capabilities is a significant factor in meeting the responsiveness consideration inherent in military operations. The speed of the conventional break-bulk ship is about 18 knots versus approximately 25 to 32 knots for container ships and RORO, SEABEE, and LASH vessels. Further, the loading and unloading efficiencies of the container

ship and the RORO and barge-carrying ships are as much as six times higher than the break-bulk freighter. For these reasons, the turnaround time of the container ship and the RORO and barge-carrying ships between CONUS and an oversea destination may be no more than one-third to one-fourth that of the conventional break-bulk ships.

8-3. Planning Considerations

Carrying out a force deployment in which unit equipment and supplies are containerized requires detailed planning based on a thorough analysis of all factors bearing upon the operation. Not to be overlooked are the interrelationships of the various factors and the ways in which they impact upon each other. To illustrate, the varying requirements for blocking and bracing of different types of cargo within a container will, to a corresponding degree, affect the usable space

within the container. This, in turn, can affect container requirements either in quantity or by size, or both. Any significant changes in container requirements, particularly in container size, may further impact upon ship requirements and materials handling equipment. From this, it is readily apparent that no planning area can be treated independently of the overall picture. The following discussion addresses the principal factors to be considered in planning the use of containers in a unit move:

Dimensions, Cube, and Weight of Unit Items of Equipment:

In order to fit each item of equipment to the proper container, it is necessary to know the dimensions, cube, and weight of the item. This information can be obtained from the following publications:

- TB 55-46-1, Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other

Outsize/Overweight Equipment (in TOE Line Item Number Sequence)

- TB 55-46-2, Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Equipment (in Federal Stock Number Sequence)

- CONARC Movement Planning and Status System (COMPASS, Equipment Characteristics Data (Dimensions, Weight, and Cube)—Vehicles and Outsize/Overweight Items Only

Accompanying Supplies:

The amount of supplies to accompany the force is governed by the size of the force, the consumption rate for the environment in which the force will operate, and the period during which the force can be expected to operate without initial resupply. Accompanying supplies are containerizable and are stowed in dry cargo containers, the dimensions of which are dependent upon the type of container ship used.



Figure 8-2. Stowing accompanying unit supplies in a 20-foot MILVAN container. The loading procedure is expedited by the use of a low mast forklift in conjunction with a mobile ramp. (US Army photograph.)

Capacity of Organic Cargo-Carrying Vehicles:

The cargo-carrying capacity of unit vehicles is used to transport compatible unit equipment.⁴ The vehicles are loaded to side rack height, thus allowing them to be containerized if the width dimension permits. If the total unit organic vehicle-carrying capability is not used for unit

equipment, the remaining capacity is used for accompanying supplies (less ammunition). Transportation of equipment and supplies in this manner minimizes the number of containers required.

Types, Size, and Number of Containers

⁴ This is known as the FREECAR (free cargo aboard vehicles) concept.

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Required and Hold and Deck Requirements for Noncontainerizable Cargo:

The Military Traffic Management Command is currently developing a program for matching equipment to containers. This program—known as COSLAN (computerized ship loading analysis)—will list by line item number each item that will not go into a closed container and then will determine which of these items can be containerized on a flatrack container. Those items that will not fit in any container will be loaded by square feet of deck space on RORO's or barge-carrying ships.

Pending implementation of COSLAN, manual computations must be used to determine loading data. Basic data in TB 55-46-1, TB 55-46-2, and COMPASS files are used to determine the total amount of equipment that is containerizable in each size and type container. From this, determination is made of the equipment that can be transported in unit organic vehicles, following which the remaining containerizable equipment is matched with containers by type and size. The hold and deck requirements are then computed for the noncontainerizable equipment.

Limitations Imposed by Loading and Discharge Facilities:

It can be expected that, for unit moves originating in CONUS, fixed port facilities will be available and adequate to load the unit containers. However, at the oversea destination fixed port facilities may be nonexistent or, if available, may require extensive rehabilitation before they can be used. In many areas it will be necessary to discharge the containers over the beach and, more likely than not, from non-self-sustaining ships.

Packing and Preservation Requirements:

Packing and preservation requirements for containerizable items are discussed in appendix B. Noncontainerized equipment is preserved and packed as required by appropriate technical manuals. In the absence of specific documents, TM 38-230-1 and TM 38-230-2 are used. For additional information and guidance for preparation of material, refer to AR 220-10.

Vehicles are generally shipped without removing wheels or tracks and are processed in accordance with technical publications for specific vehicles or other special instructions which may be issued.

- Unless otherwise instructed by the appropriate MTMC area commander, windshields are not lowered or boxed when the cargo height equals or exceeds the cab height.

- Easily removed projections should be removed or adjusted so as to present the lowest practical cube.

Aircraft are prepared for shipment in accordance with the TM 55-series or TM 1-series (Preparation for Shipment of Individual Aircraft). Assembly and disassembly of aircraft may be performed by the using unit or by personnel of direct support or general support units.

- While technically noncontainerizable, some types of Army aircraft can be transported in containers provided various components are removed. Table 8-1 indicates the models that fall in this category. Those without asterisks are outsize to containers to a degree that does not permit containerization even with disassembly.

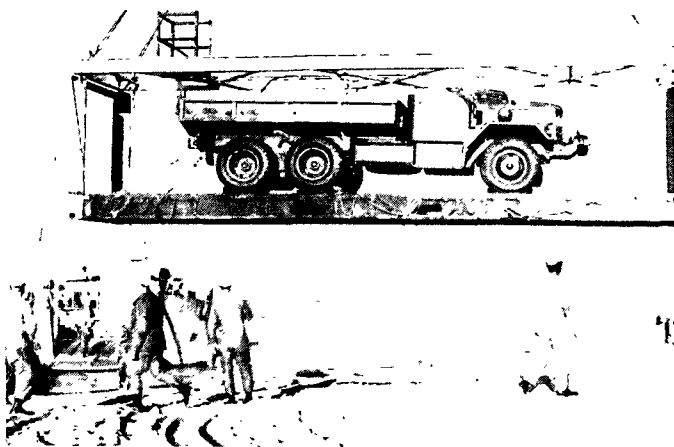


Figure 8-3. Moving a 5-ton truck over the beach during the OSDOC II test exercise conducted at Fort Story, Virginia, in October 1972. Stowed on a flatrack container, the vehicle was transported ashore by LCU from a non-self-sustaining container ship anchored offshore. The load is being lifted by a 250-ton mobile crane not visible in the picture. The container ship can be seen in the far right lower background. (US Army photograph.)

Table 8-1. Aircraft Transportable in Containers.

Aircraft	Dry cargo containers			
	8'x8'x20' (WxHxL)	8'x8'6 1/2'x24' (WxHxL)	8'x8'6"x35' (WxHxL)	8'x8'x40' (WxHxL)
OV-1 series				
U-8 series				
U-21 series				
AH-1G				
CH-47 series				
CH-54 series				
OH-6A	*	*	*	*
OH-58A	*	*	*	*
UH-1 series				

* With adequate disassembly, the aircraft listed with asterisks are transportable in containers as shown. The airframe and the disassembled components can be stored in the same container. The level of disassembly and the estimated man-hours required for disassembly and for assembly at destination are indicated in table 8-2.

Table 8-2. Aircraft Disassembly and Assembly Time (by Man-Hours) for Containerization.

Aircraft	Components removed	Disassembly time (man-hours)	Assembly time (man-hours)
OH-6A and OH-58A	Pitot tube, main rotor blades, mast, rotor head, horizontal stabilizers, tail rotor blade, tail boom section (OH-6A—8x8x20-foot container only)	8	24
OH-58A (only)	Engine exhaust stacks, tail rotor drive shaft, tail boom support, tail rotor rods; top anticollision light fixture, FM antenna	8	24

Location of Container Stowing Operation:

Contents may be stowed in containers at the unit's home station or at the port of loading. Assuming that both the home station and the port have adequate facilities, the choice of the stowing site is determined primarily by time limitations and economy of operation. A principal advantage of stowing containers at the home station is that it will permit through movement of the cargo, thus eliminating rehandling and reducing cargo damage and pilferage. However, deadheading containers to the unit station for stowing and further movement to the port may prove more costly than moving the equipment to the port for stowing. Even though it may prove more economical to deadhead containers to the unit station, it may not be possible to make the required types and number of containers available at that location within the time allotted. This situation may result partly from the policy wherein the required container ship is not nominated by name until a relatively short time before the scheduled sailing date. Obviously, the unit cannot plan its container loads until the vessel capacity and the size of its container cells are known. In this case, if the unit equipment is moved to the port marshaling area sufficiently ahead of the sailing date, the stowing of the equipment in containers can more readily be accomplished within the time allotted. It is anticipated that this situation will be improved under COSLAN; that is, the container ship will be in the program by name so that the shipping unit

will know the configuration and capacity of the vessel that will transport its equipment.

8-4. Responsibilities

The primary areas of responsibility for a containerized movement of unit equipment and supplies are discussed below:

The *United States Readiness Command (USREDCOM)* is the point of interface between the Commander in Chief, United States Army Forces, Readiness Command (USCINCARRED), and the transportation operating agency (TOA); in this case the Military Traffic Management Command (MTMC).

The *Military Traffic Management Command* provides the single point of contact with the Military Sealift Command (MSC). MTMC—

- Determines the ocean terminal through which the containerized cargo will flow.
- Upon request of the deploying unit installation transportation office (ITO), obtains the containers required for the movement.
- As indicated by relative cost effectiveness, determines whether unit equipment will be stowed in containers at the home station or at the port. If stowing occurs at the home station, moves containers to that location in sufficient time to meet established target date(s).
- Selects the CONUS mode of transportation, determines routing for movement of containers or equipment to the port, and controls the movement into and through the port.

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- Corrects and reports technical order violations and errors in documentation.
- Places requirement for ocean shipping upon MSC.
- Upon request, renders technical assistance to the ITO.

Principal responsibilities of the *Military Sealift Command* with regard to containerized unit movement:

- Nominates to MTMC the ship(s) for oversea movement.
- Moves the cargo (containerized and noncontainerized) by ocean transport to the oversea terminal.

The *installation transportation officer (ITO)*—

- Places the requirements for containers by type and number upon the MTMC area commander.
- Provides the necessary blocking and bracing material.
- Verifies correctness of documentation and compliance with applicable technical order and Department of Army Transportation and other applicable regulations and directives.
- Requests MTMC to furnish routing and rates for movement of shipment to the loading port and provides necessary transport.
- Prepares the Government bills of lading for shipment of containers and/or equipment to the loading port.
- Renders technical assistance to the deploying unit as requested and/or as otherwise appropriate.

The *unit movement officer (UMO)* is appointed by the deploying unit commander and, under his supervision, coordinates planning and movement activities within the unit and carries out appropriate liaison and coordination with the ITO. The UMO is responsible for—

- Computation of requirements for containers and the cube, weight, and quantities of equipment which cannot be containerized.
- Organization and training of unit personnel to carry out the movement.
- Development of a packing and movement schedule that will meet established target date(s).
- When containers are stowed at the unit's home station, preparation of container packing lists and their placement in the containers for which prepared.
- Documentation in accordance with the procedures set forth in DOD Regulation 4500.32-R and MIL-STD-129F.
- Antipilferage sealing and/or banding of containers.

The *oversea theater commander* is responsible for receipt of the containerized unit equipment

and supplies and for onward movement from the port of debarkation.

8-5. Summary

Study findings have substantiated the feasibility and desirability of containerizing unit equipment and supplies for oversea movement by ship. Unit deployment by containers transported in container ships—

- Provides significant savings in dollars and man-hours in the areas of transportation, cargo handling, port facilities, and shore facilities.
- Reduces ship turnaround time by as much as two-thirds to three-fourths that of conventional break-bulk ships, thereby improving ship utilization and expediting cargo movement.
- Contributes to maintenance of unit integrity throughout the movement.
- Increases responsiveness through the combination of greater cube capacity and increased turnaround capability of modern ocean ships.

Ideally, containerized unit deployment requires a mix of ship types:

- Container ships to transport containerized unit equipment and accompanying supplies, ammunition, and organic vehicles that fit on the flatrack container.
- Roll-on/roll-off vessels for wheel and track vehicles that cannot be manned on the flatrack container.
- Barge-carrying ships (LASH and SEABEE) for equipment not containerizable because of size or weight.

In planning for unit deployment by containers to be transported in container ships, the unit determines—

- Dimensions, cube, and weight of each item of equipment.
- What accompanying supplies are required by the deployed unit.
- What unit equipment and accompanying supplies can be loaded in organic cargo-carrying vehicles.
- Types, size, and number of containers required and hold and deck requirements for noncontainerizable cargo.
- What limitations are imposed by the loading or discharge facilities.
- What are the requirements for packing, preservation, and item disassembly.
- Whether containers will be stowed at the unit home station or at the loading port.

In a unit deployment by containers transported in container ships, responsibilities, functions, and procedures of the installation transportation officer, the Military Sealift Command, and the

Military Traffic Management Command are essentially the same as for a conventional unit deployment; the primary difference, of course,

results from the container and container ship planning aspect.



CHAPTER 9

CONTAINER DOCUMENTATION (STANAG 2023)

9-1. Commercial Shipment

Commercial shipment of containers is made under terms of the Military Sealift Command (MSC) Container Agreement and Rate Guide.

The container agreement provides a through service between—

- Continental United States (CONUS) inland points and
- Port commercial zones or ocean terminals and
- Oversea areas (ocean terminals, port zones, or inland points)

As discussed in chapter 10, the agreement is established by MSC making annual solicitations to ocean carriers for container service.

All containerized cargo moves in commercial service under documentation control of the military as specified in DOD Regulation 4500.32-R. For movement from CONUS, the Military Traffic Management Command coordinates with MSC in providing the shipper with necessary information and instruction, including routing of the container to the applicable ocean terminal.

Procedures for requesting and obtaining export traffic releases (including containers) in CONUS are found in chapter 202, AR 55-355.

9-2. Basic Documents

Details concerning documents and documenting procedures applicable to container movements are set forth in AR 55-355 and DOD Regulation 4500.32-R. The following presents only a brief discussion of the principal documents that pertain to container movement.

Transportation control and movement document (TCMD). The TCMD (chap 3, MILSTAMP) is the basic document prepared by the shipping activity when a shipment unit is originated. This document controls the flow of transportation data throughout the movement cycle of each shipment unit. TCMD's are used as *cargo delivery receipts, dock receipts, and tally sheets* and as *input required for preparing ocean cargo manifests*. This multipurpose document may be prepared in any one of three formats: punchcard or manual, DD Form 1384 (Transportation Control and Movement Document), or DD Form 173 (Joint Message Form). In the case of multishipment units within a container, a TCMD is prepared and placed in the container for each individual shipment unit (preparation of the

TCMD for the container (seavan) is as prescribed in para 3-29, MILSTAMP). The information given on DD Form 173 may be transmitted electrically or by mail or courier service.

Ocean cargo manifest. The ocean cargo manifest (chap 5, MILSTAMP) lists the containers (and their contents) aboard the transporting vessel and their exact stowage location. An ocean manifest is prepared for each port of loading and sent to the designated ports of unloading and the appropriate movement control activity, where it provides the basis for planning for discharge of the vessel. The loading terminal is responsible to provide the data required for preparation of the cargo manifest. The ocean cargo manifest can be prepared in one of three formats: the DD Form 1384 (TCMD) may be manually prepared, a punchcard manifest format may be mechanically prepared, or DD Form 1385 (Cargo Manifest) may be mechanically or manually prepared.

Cargo traffic message. The cargo traffic message (chap 5, MILSTAMP) speeds certain information to the port of discharge, enabling personnel to plan for cargo receipt and for rapid discharge and turnaround of the vessel. The manifesting activity is responsible for preparing and dispatching advance information concerning a ship's movement. The message furnishes the discharging terminal(s) with the ship's identity, whether or not self-sustaining, the departure time, the estimated time of arrival, subsequent ports of call, operational and handling information, total containers aboard, and a listing of the containers by destination and container number. The message is transmitted within 24 hours after the ship's departure if the voyage time is less than 8 days and within 48 hours if the voyage time is 8 days or more. Copies of the message are also furnished to MSC representatives at ports of loading and discharge.

Cargo reporting. Cargo reporting is covered by the *cargo outturn reporting system* (app E, MILSTAMP), which reports cargo discrepancies in the form of overages, shortages, apparent pilferages, and damages that occur while the cargo is in the custody of ocean carriers, their agents, or their vessels. The cargo outturn reporting system consists of three types of reports:

Cargo outturn message
 Cargo outturn reconciliation
 Cargo outturn report

9-3. Container Marking

Containers are addressed with a *waterproofed military shipping tag (DD Form 1387-1)* attached adjacent to the container seal or at the rear of the container. Instructions for preparing the military shipping tag are found in chapter 11, MILSTAMP. For movements in conjunction with NATO nations, provisions of STANAG 2023 apply (the details of agreement of this STANAG are reprinted in appendix E of this manual).

9-4. Documents Inside Container

A copy of the TCMD or other similar documentation containing TCMD data for each shipment unit in a container is forwarded with the container. The document is placed in a waterproof envelope labeled "MILSTAMP DOCUMENTATION," and is securely attached to the inside of the loading door.

A *packing list* (DD Form 1750) showing the contents of the container is placed in a waterproof envelope and secured to the inside of the container loading door.

9-5. Concepts of Documentation

Cargo documentation is accomplished through the standards established by *MILSTAMP*, which integrates DOD supply and transportation actions and provides a uniform means of documenting and conveying operational and management information through transportation channels. These standards prescribe uniform transportation documents, codes, and procedures that provide DOD transportation activities with—

A basis for *advance planning* to promote timely movement of cargo through terminals and other transshipment points.

A means for *controlling and identifying shipments* en route and at transshipment points

Information essential to *tracing, locating, and diverting shipments*

A basis for *prompt settlement* of carrier and contractor accounts

The MILSTAMP system provides three essential elements that constitute the basis for control. These are—

The shipment unit

The transportation control and movement document

The transportation control number

The *shipment unit* is a single line item of supply or a grouping of compatible line items of supply

into a transportation configuration (such as a container) for shipment to one ultimate consignee under one key transportation control number. This permits the controlled movement of material through the defense transportation system as an entity.

Containerization permits consolidation of a number of shipment units into *release units*. A shipment is called a release unit when it meets certain established criteria. Release unit criteria vary according to the type and nature of transportation service available. In CONUS, basic release units include shipments weighing 10,000 pounds or more or occupying the visible capacity of a truck, railcar, or container. In overseas areas, similar criteria are established, although the weight limit may be lower to achieve more effective use of transportation resources. *A shipment constituting a release unit must be offered to a movement control management authority for transport commitment.*

The TCMD (para 9-2) is the basic document used to control shipments that enter the defense transportation system and is required each time cargo is moved from the area of responsibility of one individual or activity to another. A TCMD is required for each shipment unit. When two or more shipment units are consolidated within a container, a TCMD is prepared for the container and a separate TCMD is prepared for and accompanies each shipment unit within the container.

The *transportation control number (TCN)* (apps B8 and B9, MILSTAMP) is the one entry that identifies a shipment unit throughout its movement in the defense transportation system. Because it identifies a basic shipping entity, the TCN may not be duplicated. When several shipment units are consolidated into a container, the container TCN becomes the prime element for movement control. Each container has its own TCN and takes the priority of the earliest required delivery date (RDD).¹ The TCN of each shipment within the container is also identified but becomes secondary to the container TCN during the movement. In CONUS, MTMC provides the container TCN to the shipper for surface export shipment of containers. In a theater, the container TCN is provided by the movement control agency. When the container reaches the consignee or the break-bulk point, individual shipment units revert to their original TCN control, thus maintaining their individual shipment unit identity throughout the logistic system.

¹ *Priority of movement* is based upon the priority of cargo established by the requisitioner. Although any movement control representative may challenge the priority, he cannot arbitrarily change it.

9-6. Summary

Under the MSC *Container Agreement and Rate Guide*, all containerized cargo moves in commercial service under documentation control of the military as specified in MILSTAMP. The shipping agreement provides for service between certain inland points and major ports in CONUS and overseas terminals and listed inland destinations. (At the option of the overseas commander, service to inland points in overseas areas may be short-stopped at the port of debarkation. The MSC container agreement provides through service from certain inland CONUS points to inland overseas destinations, subject to the overseas commander's request or short-stopping, as the case may be.)

For containers moving under the container

agreement, the TCMD is the basic shipping document and controls the flow of transportation data throughout the movement cycle of each shipment unit.

The transportation control number (TCN) identifies the container throughout its movement. A TCN is assigned at the time a shipment enters the transportation system. Each container has its own TCN and takes the priority of the shipment unit within the container having the earliest RDD.

The above and other documents and detailed documenting procedures applicable to container movements are prescribed in detail in—

AR 55-355 and

DOD Regulation 4500.32-R.



CHAPTER 10

MOVEMENT CONTROL AND CONTAINERS

10-1. Implications of Control

Control of container movement in transportation channels requires a dynamic system sufficiently flexible to be immediately responsive to every user's needs. Control procedures must permit ready identification of the container and its contents from the time the container enters the transportation pipeline in CONUS until the shipment(s) is delivered to the ultimate consignee, whether this be a theater general support or direct support supply activity or forward elements within the combat zone. Ready identification of the location, status, and contents of the container is basic to the rapid and responsive supply support envisioned in the concept of inventory in motion (para 1-8).

A container diverted to unauthorized use, one that is held, or one that is moving empty is nonproductive and contributes nothing to the transport effort. Advantages to be derived from containerization can be fully exploited only when container nonproductive time is eliminated or minimized. Reduction of nonproductive container time is the concern of every person involved in the use of containers. Shipping and receiving activities must stow, unstow, and release containers without delay, and transportation facilities and mode operators must expedite the pickup, movement, and return of containers.

The transportation movement control activity must plan, program, and manage all theater container assets to assure that containers are moved expeditiously, that they are accounted for, that empties are relocated so as to capitalize on retrograde capabilities, that backhaul is kept to a minimum, and that demurrage charges are not incurred.

10-2. Applicability of Container Management

The container management process permits the monitoring of container traffic on a current basis and, as a byproduct, provides the data base required for forecasting and scheduling functions of the management system. In peacetime operations, commercial operators are responsible to manage the use and relocation of commercial containers (that is, other than military owned and leased containers) serving military customers. However, under combat conditions, in-theater container assets operate under overall military

management. Container management procedures are generally applicable to Government owned and leased containers and cargo transporters and to commercial contractual service.

Containers used as shelters for command posts, communication centers, and maintenance facilities or those that by proper authorization are used for *extended storage* purposes (in excess of 30 days) are managed by the movement control agency only so long as they are in the transportation pipeline, after which their management passes to the acquiring agency. Containers approved by the movement control agency for use as *temporary storage* (30 days or less) remain under the transportation container management system and are controlled accordingly.

10-3. Objectives of Container Management

The basic objectives of container management and control may be summarized as follows:

- Optimize management of container cargo among the following conflicting factors:

- Maximize container loads for single consignees versus multiple consignees or oversea break-bulk points.

- Minimize holding or consolidation time of cargo in order to achieve full container loads.

- Maximize container cube utilization to achieve economical movements.

- Expedite the movement of throughput and high priority container shipments.

- Provide in-transit visibility of containers and contents.

- Obtain optimum utilization of equipment.

- Prevent conditions of container congestion or scarcity.

- Move containers as rapidly as carrier and consignee capabilities permit.

- Assure release of empty containers to carriers within prescribed time frames, thereby precluding demurrage costs.

- Trace containers and shipments en route.

- Divert or reconsign containers and shipments in response to management requirements.

- Assure that containers are provided, pulled, and/or lifted as scheduled.

- Select appropriate containers for retrograde movements.

- Provide an audit trail for resolving questions concerning payment for container service,

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demurrage, cargo or equipment loss and damage, and liability.

10-4. Concept of Operations

Procedures for control and management of container assets in the transportation system basically parallel those for other types of unitized cargo. However, there is one major difference—and this is significant—with containerized cargo, there is not only the cargo to be considered, but the container as well.

Because the container is itself a permanent article of transport equipment designed for repeated use, its control must be established at an echelon that permits surveillance of the overall container situation and centralized management of all container assets in the theater. Within the theater, that echelon is *the theater army (TA)*. The controlling activity is the *transportation command (TRANSCOM) movement control agency (MCA)*; more specifically, the *freight movement division within the movement control center of the MCA*.

Within broad policy directives issued by the theater commander, the freight movement division develops and monitors the execution of detailed policies and procedures for container service, exercising theaterwide control over all Army owned and leased containers and monitoring and tracking containers provided by commercial contractors.

The freight movement division has access to the TRANSCOM computer data bank in which is stored container status input transceived or telexed from transportation movement offices, highway regulating points, and other sources which may report direct to the movement control agency. Sources of data input include—

Cargo manifests and advance transportation control and movement documents from CONUS.

Passing reports and requests for diversion or reconsignment.

The daily seavan status report submitted by container handling activities including ports, depots, other shipping and receiving activities, transshipment points, and consolidation and distribution points.

The TRANSCOM computer data bank can be queried either by transportation control number or by container number to obtain a printout of container information to include, as appropriate—

- Type, size, weight, and cube of contents
- Mode and carrier
- Routing
- Shipping date
- Origin
- Destination

Required delivery date

Arrival date

Location

Empty date

Date demurrage starts

Departure date

Return destination

Return condition (stowed or unstowed)

Data can also be programed into the computer bank to provide other types of control information, such as—

Total number and location of containers in the theater by container number, type, and size.

Number and location of empty containers in the theater by container number, type, and size.

Containers moving intratheater or intertheater (inbound or outbound) by transportation control number and/or container number; mode and carrier identification; departure point and date; weight, pieces, and cube of container contents; destination; and estimated time of arrival at destination.

Although not to the extent desired, current container control procedures and available automated equipment do permit a degree of visibility of assets in the transportation pipeline. To illustrate, when cargo is stowed in the container for shipment, a packing list is prepared showing the container contents by nomenclature. One copy is placed in the container, and one is retained in the files of the stowing activity. Should it become necessary to identify the container contents en route, it is possible to do so by breaking the container seal and examining the load list inside the container. However, if it is desired that the container seal remain intact, inquiry may be transceived or telexed to the appropriate activity (the movement control agency in the theater or the Military Traffic Management Command area headquarters in CONUS), citing the container transportation control number and/or the container number. The queried activity identifies the container contents by manual reference to activity files and transceives or telexes its reply to the inquiring activity. In the same manner, it is possible to identify a container carrying a specific shipment.

Ultimate automated movement control procedures and equipment, as envisioned in the *integrated transportation management information system (ITMIS)*, will incorporate all required movement data in the central data bank and provide on-line input/output devices to field activities, thereby permitting realtime access to the data without recourse to manual searching of files. Implementation of ITMIS will permit the degree of visibility of assets in the transportation

pipeline that is required to complement and support the concept of inventory in motion.

At each installation or activity that receives, transships, or dispatches containers, control and reporting of container movements are carried out by a *container control officer* who is appointed on orders by the installation or activity commander. The container control officer is responsible to the installation or activity commander to see that—

Containers are inspected jointly with the carrier's representative for physical condition at the time of receipt and time of release. Evidence of damage, broken seals, or other discrepancies is noted on the inspection form (which is signed by both parties) and reported in accordance with theater policies.

SEA CONTAINER CONTROL DOCUMENT					NO.
FOR : ☐ TGBL ☐ NON - TGBL SHIPMENTS (USAREUR Reg 55 - 355) (Check)					
(Does not acknowledge receipt of cargo)					
CARRIER	TGBL NO.	TGBL VOYAGE NO.	NON - TGBL VOYAGE NO.	CONTAINER NO.	TO BE RETURNED PRIOR TO 2400 HRS (Date)
MARK CLEARLY ALL DAMAGE OR DEFICIENCY FOUND BY INSPECTION SYMBOL 'B' BRUISE - 'C' CUT - 'H' HOLE					
INITIAL RECEIPT AND INSPECTION			RETURN RECEIPT AND INSPECTION		
LEFT SIDE	FLOOR	FRONT	LEFT SIDE	FLOOR	FRONT
TOP			TOP		
RIGHT SIDE		REAR	RIGHT SIDE		REAR
INITIAL RECEIPT			RETURN RECEIPT		
INSTALLATION			DATE		
RECEIVED FROM (Name and title)			RECEIVED BY (Name and title)		
CONDITION OF CONTAINER (Insert details)			(Attach additional sheets, if necessary)		
APPARENT CONDITION OF CARGO (SF 361 to be submitted if loss or damage is indicated)			(Attach additional sheets, if necessary)		
NAME OF EVALUATOR		SIGNATURE		DATE	
INSTALLATION			DATE		
RETURNED BY (Name, signature, title)			RECEIVED BY (Name, signature, title)		
CONDITION OF CONTAINER (Insert details)			(Attach additional sheets, if necessary)		
DETENTION					
REASON FOR DETENTION BEYOND ALLOWABLE FREE TIME					
(Attach additional sheets, if necessary)					
FUND CITATION FOR DETENTION CHARGES					
DISTRIBUTION					
Original & 3d Copy : To Carrier					
2nd, 4th & 5th Copies To Receiving Installation (One copy of these to be furnished US Army Central Finance & Accounting Office, Europe, to support detention charges; one copy to be attached to SF 361, if submitted.)					

FORM
AE 1 SEP 71 1128

Figure 10-1. This particular document used by US Army, Europe, is typical of the container inspection report used by commercial operators and may be reproduced locally, or the carriers' forms may be used, as appropriate.

Containers are properly spotted for stowing or unstowing.

Containers are released within the established time period to (in the case of commercial containers) preclude demurrage and detention charges.

Based on a daily physical inventory, a record is maintained of each container on hand showing, as a minimum, the type, size, and number of the container; carrier; condition; arrival date; empty date; required release date; actual release date; and to whom released.

The daily seavan status report (compiled from the results of the daily inventory) is forwarded through the transportation movement office (or direct, when appropriate) to the movement control agency, which in turn transceives or telexes the report to the Joint Container Control Office, Tobyhanna Army Depot, as outlined in AR 55-1.

Contractual service agreements normally establish free time limits within which the stowing and unstowing of commercially owned and operated containers may be accomplished. Since demurrage charges start after this time has elapsed, it is imperative that using agencies make every effort to complete their operation within these limitations and to control cargo loading and unloading procedures to meet the established restrictions. Military owned and leased containers will be stowed and/or unstowed expeditiously within a time limit established by the theater commander. Normally, however, the container will not remain at a consignee site for a period in excess of 48 hours. This time restriction is mandatory to maintain a balance between the number of containers arriving in, within, and departing a theater of operations and to—

Assure that containers are not diverted to uses for which they are not intended. To illustrate, untold numbers of CONEX containers in the field have, in the past, been lost to the system by being converted to command posts, personnel shelters, covered storage, and similar uses.

Assure maximum utilization of container ship space. This requires that during movement of cargo by container ship all container cells be occupied. Therefore, containers in transit and on site within the theater must be scheduled and controlled to assure that the number of containers on hand at the terminal for return to CONUS be in direct proportion to the number of containers coming into the terminal from CONUS.

Prevent buildup of container backlogs at the port, depot, transfer point, consolidation and distribution point, or consignee site. Schedule and control must provide a systematic and continuous flow of containers into and out of the

affected activity to prevent backlogs of empty containers. The imbalance resulting from backlogs results in area congestion and lowered operating efficiency and, of equal significance, prevents maximum utilization of line haul equipment.

Assure availability of containers. Expeditious unstowing of containers and placing them back into the container loop between shipping points and consignees make it possible to have a desired supply of containers on hand at specific locations as required. This may be at shipper sites, depots, terminals, or consignees.

Finally, efficient line haul motor transport operations depend upon a constant availability of tractors and trailers in the transportation pipeline. This is possible only through close control of motor transport equipment. For this, and essentially the same reasons as discussed for containers, line haul chassis and semitrailers of transportation truck units will be released to the movement system within the time limits prescribed for containers.

Programming the use of containers for retrograde movement of cargo is a significant part of the management and control function of the movement control agency. Because it is uneconomical to backhaul empty containers, they should be used to the maximum to transport retrograde material. In planning retrograde movements, the MCA considers—

Whether any suitable retrograde cargo for CONUS, including mail, is available at or near the theater destination of the inbound container.

Whether a CONUS retrograde lift exists at another theater installation and does not involve an excessive lateral or forward empty movement in order to use empty chassis or container space.

Whether a requirement exists for an intratheater retrograde movement that would not unduly delay the return of controlled equipment if it were used for the lift.

Whether the container should be returned empty to an appropriate terminal for loading with retrograde cargo for CONUS.

Whether the container should be returned empty to CONUS.

10-5. Responsibilities of CONUS agencies

Within CONUS, two agencies have primary responsibility for control of containers: the US Army Materiel Command Packaging, Storage, and Containerization Center (AMCPSCC) and the Military Traffic Management Command (MTMC).

AMCPSCC, through its Joint Container Control Office is responsible to—

- Manage jointly owned (US Army and US Air Force) CONEX containers.

- Exercise administrative control of Army owned and leased containers and chassis worldwide, and operational control in CONUS.

- Allocate Army owned and leased containers to using activities in CONUS, and issue orders to effect relocation of containers located in CONUS.

- Maintain surveillance of availability data concerning Army owned and leased containers and chassis and, in coordination with the theater commander, initiate their relocation to maintain balanced inventories and to insure efficient utilization.

- Maintain centralized container movement records for Army owned and leased containers, verify and reconcile electronically processed data, and adjust records as required.

Responsibilities of MTMC with relation to container management and control in CONUS include—

- Receive from the shipper and process the export release request for container service.

- Consolidate requirements and place requirements for ocean shipping upon the Military Sealift Command.

- Determine mode and routing for movement of containers to port and control container movement into and through the port.

- Control and document export and import containerized cargo.

- Provide areas for stowing and unstowing container contents when required.

- Prepare and transceive export cargo punchcard transportation control and movement documents and cargo manifests for cargo originating in CONUS and at MTMC-operated transportation terminals overseas.

- Coordinate with the oversea command in tracing cargo that has been shipped under standard documentation and control procedures prescribed by military standard transportation and movement procedures (MILSTAMP).

10-6. Responsibility for Ocean Voyage

The *Military Sealift Command (MSC)* is responsible for providing MTMC and the oversea theater with sea transport for moving DOD-sponsored containerized cargo.

From shipping requirement estimates submitted by shipping activities, MSC computes the total shipping space that will be needed worldwide during the period of time covered and, through the use of container agreements (MSC Container Agreement and Rate Guide) or other shipping contracts, procures the necessary container ship service.

The *container agreement* does not obligate MSC to offer or book any cargo but establishes the rates, terms, and conditions applicable to each segment; that is, pier-to-pier service for each trade route, CONUS inland haul, drayage within the port commercial zone in CONUS, and line haul rates for inland movement in oversea areas. The agreement covers both commercial containers and Government owned and leased containers. Movement of cargo is under documentation control of the military, including movement through military owned or controlled facilities, and incorporates the provisions of MILSTAMP.

Container agreements are negotiated for each of the established trade routes over which DOD cargo moves in substantial quantities or at frequent intervals. Carriers competing on the same trade routes have similar agreements to give service under the same terms and conditions. The MSC Container Agreement and Rate Guide covers major trade routes and includes participating US flag carriers operating over these routes. The competitive position of each participating carrier is protected for a 6-month period, based on the rates submitted in response to the semiannual solicitation made by MSC.

Under shipping agreement procedures, MSC nominates a specific carrier for the ocean voyage when a cargo offering is received from MTMC.

In addition to procuring commercial shipping service through the use of the container agreement, MSC also negotiates for *contract carrier service* on trade routes that are not fixed. Because these ships do not operate on fixed routes, no tariff can be developed and all rates must be negotiated between the ship operator and the cargo owner (in this instance, the shipper services are the cargo owners, and MSC acts as their negotiating agent). Contract carriers are usually hired (chartered) for the exclusive use of the Government for a particular voyage or period of time. The rates, terms, and condition of hire are negotiated between the parties at the time of hire. The time charter and the voyage charter may well be used in resupply of contingency operations in areas not adaptable to the use of large non-self-sustaining container ships.

A *time charter* is a contract for the full use of a ship for a designated period of time, wherein the entire cargo capacity of the ship is placed at the disposal of the charterer.

A *voyage charter* is a ship contract for the carriage of a full or partial cargo for a specifically defined voyage.

10-7. Responsibilities of the Theater Army Commander

A major concern of the theater army commander

with respect to container management is the maintaining of the forward momentum inherent in containerization. This is particularly true with regard to support of the concepts of *throughput of supply* and of the *direct support system*. With this in mind, the commander's policies are directed toward maintaining a dynamic management system, sufficiently viable and flexible to satisfy the constantly changing support requirements of the combat elements in the forward area.

The theater army commander's responsibility for container management and control begins when the container departs the CONUS port of loading en route to the theater and continues until the container departs the theater in retrograde movement.

The theater army commander exercises his responsibilities for container control through the TRANSCOM commander who, in the name of the theater army commander, develops and issues policy directives for the guidance of the various elements of the theater transportation movement management and operating system. The functional aspects of container management and control in the theater army are carried out by the freight movement division within the movement control center (MCC) of the TA movement control agency (MCA). The MCA is a major subordinate unit of the transportation command (TRANSCOM). (Refer to FM 55-11 for a detailed discussion of the TRANSCOM.) Within a theater of operations that has not developed to the point that a TA has been established, the MCC of the senior army headquarters in the theater exercises the commander's responsibilities for container control.

Responsibilities of the theater army commander with respect to container management and control include the following:

- Maintain interface with the Military Traffic Management Command.
- Maintain interface with the Joint Container Control Office.
- Coordinate the use of military transport for intratheater movement of containers.
- Coordinate the use of host and allied nation facilities in intratheater movement of containers.
- Negotiate customs requirements with host nations.
- Maintain liaison with the theater port activity of the Military Sealift Command.
- Designate the port(s) at which container ships will be discharged/backloaded.
- Provide facilities, trans-hydro craft (lighterage), cranes, and materials handling

equipment for the discharge and backloading of container ships.

- Provide necessary marshaling space at the port for temporary in-transit holding of inbound and retrograde containers.
- As required, provide facilities for consolidation and distribution operations.
- Provide personnel (military or contract) to operate the facilities for loading/discharge and documentation.
- Provide intratheater movement and in-transit monitoring, tracking, and control of containers in the transportation movement system.
- Maintain a record of the current physical and time status and location of each container in the theater. As indicated by this record take action to expedite movement, stowing/unstowing, and release of containers and relocation to meet retrograde requirements and other actions to realize the maximum potential and economy of containerization.

10-8. Use of Automatic Data Processing

The system outlined here is an interim one that provides a transition from the current basically manual system for container management to the advanced scanner and label procedures described in chapter 11 of this manual. The interim system will promote development of additional experience data and refinement of procedures for use in the advanced scanner and label system. It requires no alteration in the current basic design of MILSTAMP, but it will improve MILSTAMP data gathering and processing so that container traffic can be monitored and controlled more effectively. The system is applicable to *intratheater* and *intertheater* movement of military owned and leased containers and of commercial containers.

As a basis, theater movement management and supply activities must interface with the *automatic digital network (AUTODIN)*; that is, ports of debarkation, movement control centers, transportation movement offices, general support supply activities, direct support supply activities, division support commands, and mode operators—all must have access to the AUTODIN net in order to report and obtain container status information.

Computers are located at the major theater terminals and at the transportation command (TRANSCOM). These computers have a data storage capacity that can accommodate current files of container movement data. The *master container data file* is located at TA where it is managed by the movement control agency.

Where the advanced system will rely on labels and scanners to transmit container status information, the system discussed here is based on input cards. When a change in container status occurs, an input card is prepared and the information is forwarded to update the master file at TRANSCOM. In essence, this system requires the preparation of input cards each time that a scanner will be used in the advanced system.

Based on the advance manifest from CONUS, the terminal command at the port of discharge prepares a *manifest header card*. This card provides a clear text vessel name for a specific voyage number and permits insertion of the vessel name into the master records for containers arriving in the theater on a specific voyage. Prime cards are automatically prepared for each container and provide input to the container control system.

When the manifest is not received before the ship arrives, the voyage number and vessel name can be obtained from the cargo traffic message. This permits limited initial planning before the ship's arrival, at which time a copy of the manifest can be obtained from the vessel's master.

Upon arrival of the vessel in port, the containers are discharged and a *port arrival card* is prepared for each container. This card updates the master record to reflect containers actually received, and serves as a basis for comparison with the originally manifested containers.

Status change cards are submitted for each container as it—

- Departs the port
- Changes mode en route
- Arrives at destination
- Is unstowed
- Is released to carrier
- Is relocated and/or stowed
- Reaches the date that demurrage begins
- Departs its destination
- Changes mode en route
- Arrives at port for release on a vessel outbound from the theater
- Departs the theater

Additional cards provide for identification of specific containers carrying cargo for more than one consignee, for containers which are recon-

signed, and for containers loaded for retrograde movement. The cards serve to update the movement control agency master file and, in so doing, also serve to maintain more accurate and timely information for use by movement control personnel.

It should be noted that use of the manual card system presents a major disadvantage in the form of possible introduction of error. Such error causes the computer to reject the card, thereby creating a requirement for corrective documentation. Even more serious are errors *not* detected by the machine and, consequently, introduced.

10-9. Summary

Container movement control procedures must—

- Provide in-transit visibility of assets from the time the container enters the transportation pipeline until the shipment is delivered to the consignee.

- Provide flexibility and immediate responsiveness in satisfying the user's needs.

- Assure that containers move expeditiously, that they are accounted for, that empties are relocated to provide maximum use of retrograde operations, that backhaul and cross-haul are held to a minimum, and that demurrage and detention costs are eliminated.

- Provide realtime or near-realtime interflow of information between movement control personnel, shipping and receiving activities, transportation facilities, and mode operators as a basis for expediting container movement and reducing nonproductive container time.

- Prevent container congestion or scarcity.

Although not to the extent desired, current container control procedures and available automated equipment do, to a degree, satisfy the requirements inherent in container control and management.

Automated movement control procedures and equipment, as envisioned in the integrated transportation management information system (ITMIS), will incorporate required movement data in a central data bank and provide on-line input/output devices to field activities, thereby permitting realtime access to the data.

CHAPTER 11

FUTURE DEVELOPMENTS

11-1. The Requirement

In general, container ships will not be self-sustaining, and will thus require deep draft ports; fixed facilities; and heavy, cumbersome, and relatively immobile container lifting and handling devices. During contingency operations or actual warfare, these sophisticated port facilities may not exist or, if available, may be unusable because of enemy action. Additionally, it may not be possible to use commercial transport for intratheater transport of containers under combat conditions. Hence—

There is an urgent requirement for new and/or improved equipment and procedures that will assure rapid movement and responsive control of containerized military cargo within all environments. Some future developments envisioned in these areas are discussed in the following paragraphs. It is stressed that the equipment, material, and systems discussed have not as yet been adopted by the Army but

represent concepts envisioned in ongoing related studies.

11-2. Heavy Lift Helicopter

Tests employing CH-47 and CH-54 helicopters as lighterage have proven the feasibility and practicability of helicopter lift (heli-lift) for rapid discharge of containers from the decks of container ships. However, since the lift capability of the CH-47 and CH-54 helicopters is limited to a maximum of 10 and 12 short tons, respectively, and the maximum gross weight of a fully loaded 20-foot MILVAN is 22.5 short tons, these aircraft do not fully meet lift capability requirements and therefore cannot fully capitalize upon the potential versatility, flexibility, and speed inherent in a heli-lift operation. To resolve this problem, a program is underway to develop a heavy lift helicopter (HLH) capable of externally lifting and transporting the fully loaded 20-foot MILVAN container.

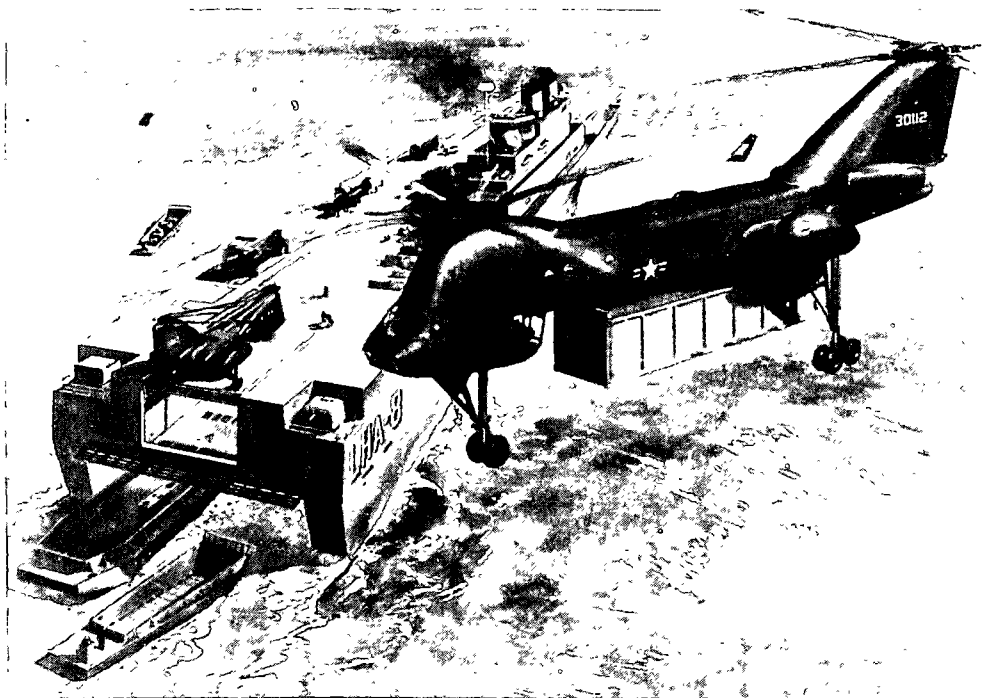


Figure 11-1. Artist's concept of the heavy lift helicopter (HLH). Capable of externally lifting the fully loaded 20-foot MILVAN container, the HLH will provide versatile, flexible, high speed lighterage for discharge of container ships and for movement of containers to marshaling areas, terminal transfer points, and direct support and general support supply activities and, when required, direct to the user. (Sketch courtesy of the Army Logistician magazine.)

The HLH will provide high speed lighterage for discharge of containers from the decks of container ships, including the discharge of offshore ships underway. Delivery may be to container marshaling areas, terminal transfer points, and direct support or general support supply activities or, if required, direct to the user. Delivery will be without regard to port facilities, over-the-shore conditions, rail or highway nets, rivers, or other obstacles.

The current stage of development of the HLH involves the design, fabrication, and test of the major components of the helicopter.

11-3. Shipboard Container Lifting Device

The concept of using helicopters to discharge containers from non-self-sustaining container ships has proven sound. This is especially true when no fixed port facilities are available, when existing facilities are damaged, or when the sea state hampers or prohibits the use of floating lighterage. One of the most critical variables involved in the use of helicopters is the time required for the helicopter to hover over the load, acquire the load, and lift it away from the ship (hover acquisition time). The less the hover acquisition time, the greater the efficiency of operation. For this reason, containers should be prepositioned at the main deck level before the helicopter arrives. When the container ship is not equipped with a shipboard container lifting device, one should be provided from an external source to accomplish this task. While it is possible to equip a helicopter with the required instrumentation and other equipment necessary to lift containers from a ship's cells, the development of such specialized equipment has been shown to be economically unfeasible and it is not envisioned that helicopters of the future will be so equipped. Therefore, there exists a requirement for a shipboard container lifting device to raise containers to deck level where they can be picked up expeditiously and safely by helicopter. This device can also be used to supplement all other LOTS discharge systems and thereby increase the productivity of these systems.

Characteristics: The device should be—

Capable of lifting ANSI/ISO standard containers weighing up to the maximum payload capacity of the heavy lift helicopter.

Designed to lift containers from the container cell to the deck so that a helicopter or external crane using an externally suspended container adapter or spreader bar can acquire a container at deck level.

Capable of repositioning from one container cell to another under its own power (or by helicopter or external crane lift) within a period

of 5 minutes

Usable with all types of cellular non-self-sustaining container ships.

Operational concepts:

The container lifting device will be prepositioned on or moved to the container ship by external helicopter or external crane lift.

After hatch covers are cleared of containers and removed, the lifting device is moved into position by helicopter or external crane or under its own power.

Containers are lifted to deck level for removal by helicopter or external crane.

The lifting device moves from cell to cell under its own power, by helicopter lift, or by external crane lift.

When all cells are emptied, the lifting device is removed by helicopter or external crane or it may remain on ship to be used in loading retrograde containers.

11-4. Air Cushion Vehicle

A commercial air cushion vehicle (ACV) designed to carry cargo was tested by the Army during the Offshore Discharge of Container Ship Exercise (OSDOC II) conducted at Fort Story, Virginia, in October 1972. The tested craft was unable to transport a fully loaded 20-foot container. It did, however, transport two containers plus 3 tons of excess fuel for a maximum payload of 19 tons

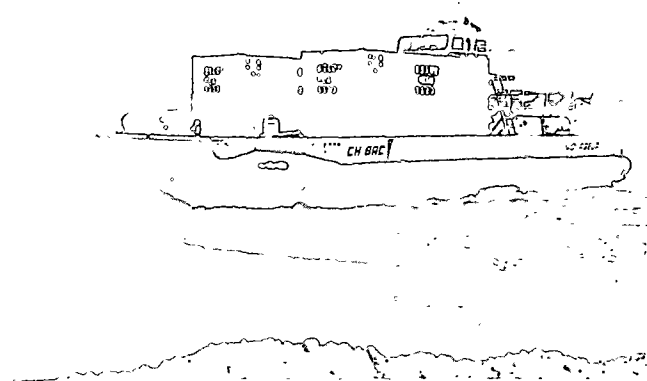


Figure 11-2. The commercial model air cushion vehicle shown here is transporting containers from a container ship anchored offshore during recent test exercises. This craft operated with a payload of approximately 19 short tons, including 3 tons of excess fuel, and cruised at approximately 30 knots. Because it operates above the surface, loss of efficiency due to friction is eliminated, as is also the requirement for a complicated engine-to-wheels power train. The ACV has safely negotiated a 3-4 foot surf. (US Army photograph.)

Because of the test times achieved by the ACV and its demonstrated ability to cross the surf and beach to trafficable soil, the ACV concept shows merit in ship-to-shore container discharge

operations. However, the tested craft does require modification and improvement to meet military requirements. The following discussion covers characteristics and capabilities of the ACV considered suitable for ship-to-shore container operations:

Characteristics of the ACV (based on standard day operating conditions):

Can perform satisfactorily in worldwide operational environments and in climatic conditions ranging from extreme cold to hot and humid.

Has a cargo deck designed to—

- Accommodate all classes of supply required to provide combat service support and combat support to military forces.

- Accommodate one or more loading ramps that permit self-loading and self-discharge of vehicles and engineer equipment weighing up to 25 to 30 short tons. (Additionally, a roll-through or roll-across capability is desirable.)

- Provide equipment such as winches, rollers, conveyers, air-lubricated devices, or similar equipment for positioning cargo on deck.

- Accommodate removable lifting gear capable of unloading TRICON's and 8x8x20-foot containers at destination.

Capabilities:

Can transport up to three 8x8x20-foot containers or nine TRICON's having a maximum gross weight of 25 to 30 short tons.

Can operate over water, sandy beaches, land, snow, ice, and marginal areas.

Can operate in waves and plunging surf as high as 8 feet and can clear 3- to 8-foot obstacles (3-foot vertical and above 3 feet on a slant).

Can cross ditches 10 to 20 feet wide and (desirably) 8 to 10 feet deep.

With a running start for a distance of at least 50 yards, can climb slopes having a gradient of 20 to 30 percent.

Can cruise over water with maximum payload at speeds of 30 to 50 miles per hour, with burst speeds up to 60 miles per hour; can cruise overland with maximum payload at reduced speeds consistent with terrain and safety considerations.

Has a minimum endurance of 5 hours at cruise speeds with maximum payload.

Has a get-home capability in the event one engine fails.

Modular construction permits disassembly of craft into a number of easily handled sections to meet transportability requirements.

11-5. 60-Ton Wheeled Hydrofoil Amphibious Lighter

The 60-ton amphibious hydrofoil lighter is a conceptual craft that will satisfy the Army requirement for a lighter that can self-load, transport over the beach, and self-offload diversified cargo weighting up to 60 short tons. It is ideally suited for rapid discharge of container ships and is well within the state of the art.

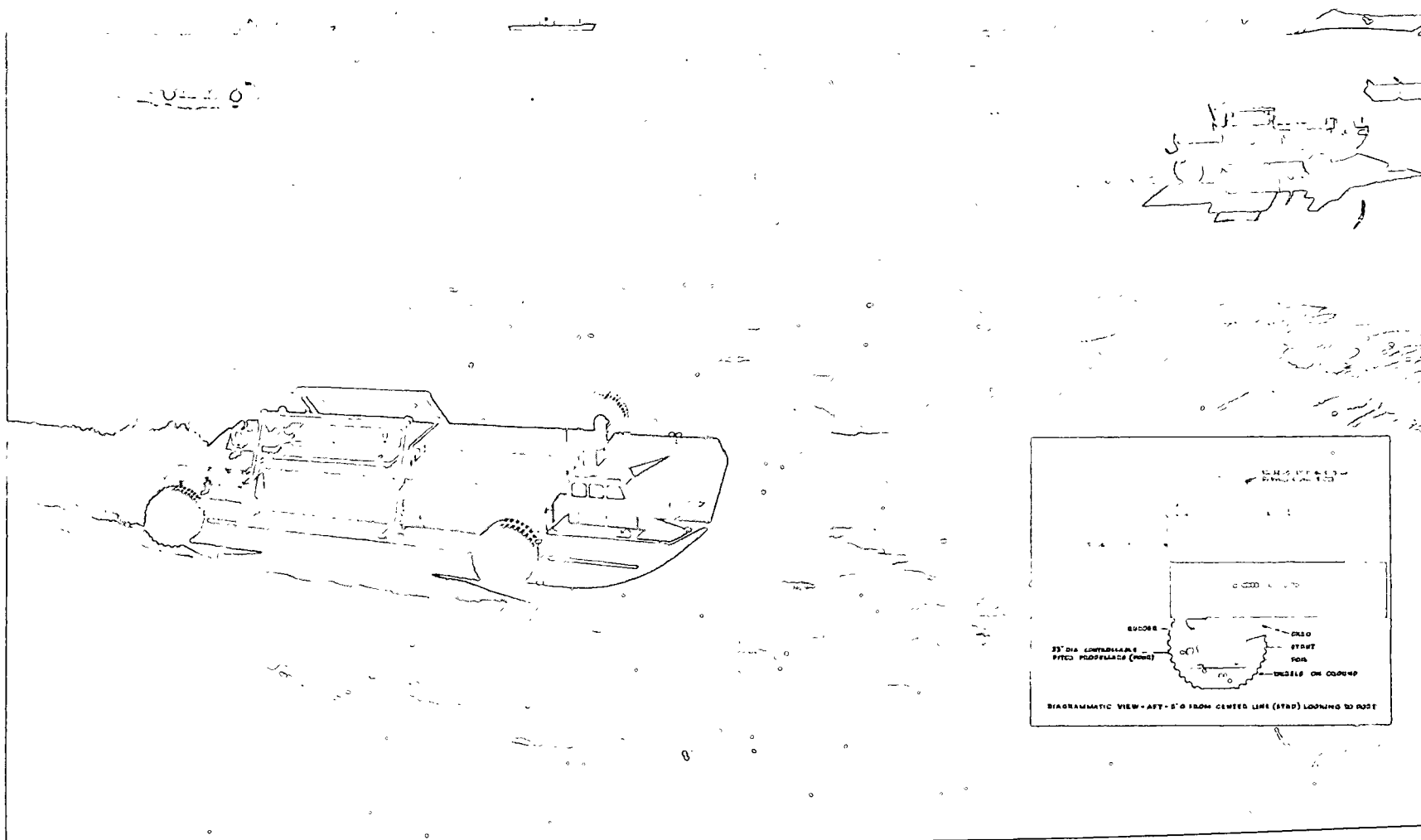


Figure 11-3. This conceptual 60-short-ton amphibious lighter, which becomes foilborne at 17.5 knots, has a maximum speed of 35 knots with full load. It has a drivethrough capability and a cargo self-handling capability, and can carry four 20-foot MILVAN containers.

Characteristics:

Has a hull length of 79 feet and an extreme width of 44 feet 2 inches.

Cargo space dimensions are 45 feet long by 20 feet wide.

Has a gross weight of 412,170 pounds with full payload and full fuel.

Has a hydraulically controlled ramp at the bow and a tailgate at the stern.

Has two sets of davits for self-loading: one on the port side and one starboard.

Retractable wheels permit land operation (because of size and gross weight, the craft will leave the beach only on carefully prepared routes).

Becomes foilborne at 17.5 knots.

At its maximum speed of 35 knots (in 2- to 4-foot waves) with full load displacement, is designed to fly with a hull clearance of approximately 2 feet above the waterline.

Capabilities (not designed for assault landings on an unsecure beach):

Can carry four MILVAN containers stowed longitudinally and two abreast on the centerline.

Has drivethrough capability.

Has cargo self-handling capability (by virtue of port and starboard davits).

Is fully operational at 35 knots in 2- to 4-foot waves; operates at reduced speed in waves above 4 feet.

Can negotiate an 8-foot plunging surf.

At gross weight, has an endurance of 265 nautical miles at a speed of 35 knots.

Has a get-home capability with one engine operating.

11-6. 300-Long-Ton Beach Discharge Lighter

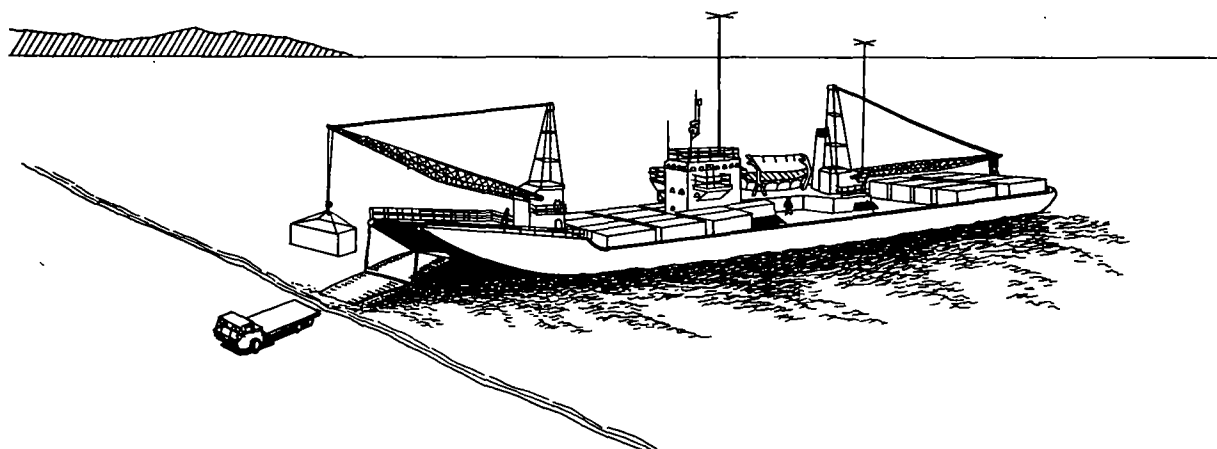


Figure 11-4. The conceptual 300-long-ton beach discharge lighter will be used primarily in logistics over-the-shore operations. Having drivethrough capability and its own revolving cranes, it can handle 20- and 40-foot containers, roll-on/roll-off and break-bulk cargo, and heavy or outsize items. It is self-deployable overseas.

The 300-long-ton beach discharge lighter is a conceptual trans-hydro craft that will satisfy the Army requirement for a *self-propelled beaching craft* for transporting MILVAN and other containers, as well as roll-on/roll-off (RORO) and break-bulk cargo and heavy or outsize items, primarily in logistics over-the-shore operations.

Characteristics:

Has an overall length of 278 feet and an overall width of 49.7 feet.

A stern tailgate 24 feet wide provides an access for RORO cargo, and a bow ramp 16 feet wide provides for offloading of RORO cargo and permits trucks or trailers to back up to the craft for offloading containers.

Has two (one forward and one aft) fixed-base revolving cranes, each having a lift capacity of

45,000 pounds at maximum outreach and 70,500 pounds at a 40-foot radius.

Draft in light condition (no payload, but sufficient fuel to operate 20 hours at full power):

Forward	2.5 feet
Aft	7.9 feet

Draft in the beaching condition (full cargo and fuel to operate 20 hours at full power):

Forward	4.0 feet
Aft	8.9 feet

Capabilities:

Has the following container cargo capacity:

Containers	At maximum rated weight	At 75 percent of maximum weight
20-foot	15	20
40-foot	9	9 ¹

¹ Reducing the weight of the 40-foot containers does not increase the number that can be carried—this is because of space limitations.

Has capacity for other cargo as follows:

RORO 300 long tons; approximately
480 feet of 12-foot wide aisles
Break-bulk 300 long tons; approximately
7,800 square feet

Has a drivethrough capability.

Has a forward crane to offload containers over the side and over the bow.

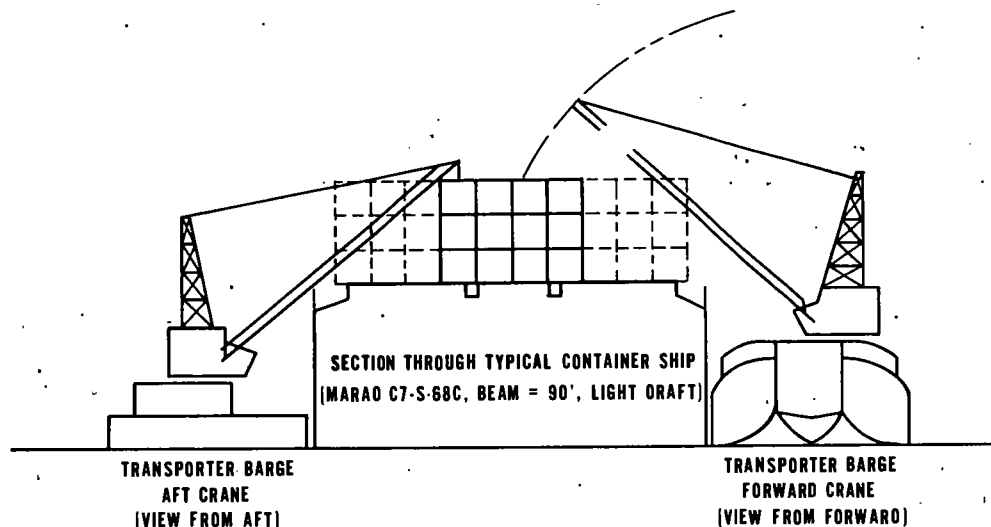


Figure 11-5. As illustrated here, the 300-long-ton beach discharge lighter has a limited capability for discharging container ships. It can also load and offload other barges and small ships.

Can handle cargo in wave heights up to 8 feet.

Can safely negotiate 10-foot plunging breakers.

Is suitable for operation on inland waterways and for coastal service.

Is self-deployable overseas.

At full load, a range of 7,900 miles at 15 knots is possible; estimated endurance at 8 + knots with a clean bottom in calm seas is about 14,000 miles, assuming a full load of fuel.

11-7. Sectionalized Barge

The Army requires improved causeway and

floating pier equipment that is readily deployable overseas and that can be rapidly assembled at destination without tools. This type of equipment is particularly required in a LOTS operation to promote a more flexible and rapid means of moving containers and vehicles between ship and shore.

Tests of the *MEXEFLOTE* barge equipment indicate that it may be suitable for Army adoption and that it may be a suitable replacement item for the 81-foot sectionalized nesting barge currently in the Army inventory.

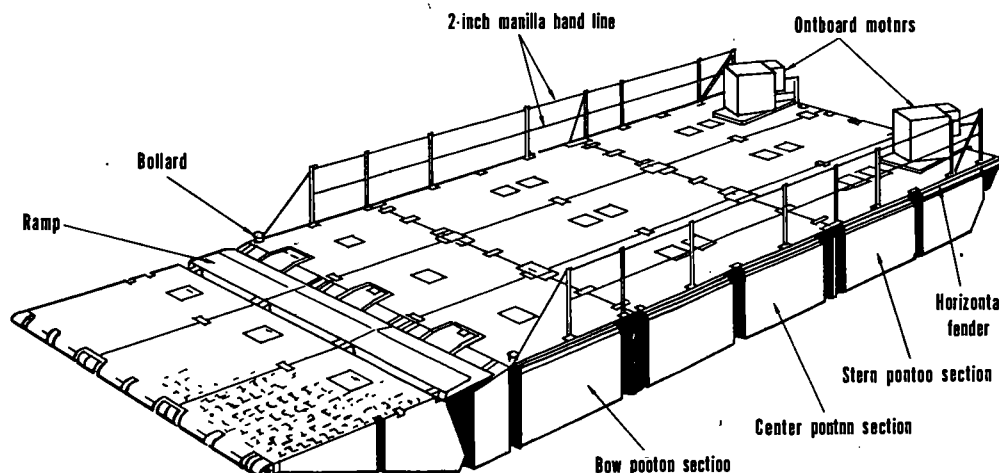


Figure 11-6. *MEXEFLOTE* barge equipment can be used as floating working pier at container ship side or at the beach site as a self-propelled or towed floating platform for movement of containers from the ship to the shore handling facilities, or as a floating causeway extending from an offshore platform to the beach. When used as a self-propelled barge, it is powered by two 75-horsepower outboard propulsion units mounted on the stern. With a 60-short-ton load, the barge has a speed of 7.5 knots.

Characteristics of the MEXEFLOTE barge equipment are—

Consists of pontoons (constructed of high-strength structural steel) for the bow, center, and stern configurations together with necessary connecting elements.

Pontoons are 8 feet wide and 4 feet 9 inches deep. The bow section is 26 feet long, and the center and stern sections are each 20 feet long.

Weight of each ponton:

Bow ponton	13,000 pounds
Center ponton	10,240 pounds
Stern ponton	9,720 pounds

The pontoons have no projections on the deck or the sides and are joined rigidly side by side and end to end with a 2-inch spacing between pontoons.

The MEXEFLOTE unit consists of three bow, three center, and three stern pontoons and, when assembled, is 67 feet 4 inches long and 24 feet wide.

Assembled barges can be joined end to end to form a floating causeway.

The ramp on the bow section is controlled by a built-in manually operated 80-short-ton-capacity hydraulic jack; the ramp is adjustable from 15 inches below the bottom of the ponton to 18 inches above the level of the deck.

The barge is powered by two 75-horsepower outboard propulsion units mounted on the stern. With a 60-short-ton load, the barge has a speed of 7.5 knots.

Capabilities: Can serve as a—

Floating working pier at container ship side or at the beach site.

Self-propelled or towed floating platform for movement of containers from the ship to the shore handling facilities.

Floating causeway extending from an off-shore platform to the beach.

Further testing of MEXEFLOTE will include the

capability for sealift of individual sections of the barge on the lighter aboard ship (LASH) and the sea barge (SEABEE) vessels and of movement compatible with the oceangoing tug-barge concept.

11-8. Synthetic Surface Stabilization

Concepts of offshore discharge and movement of containers over the beach and inland require a capability for rapid surface construction in remote areas. Included are *beach areas, container transfer and storage areas, equipment operation and parking areas, and helicopter pads*

In a LOTS operation, the requirement for rapid completion and immediate usage and the limited requirements for permanency neither permit nor warrant the use of conventional materials such as concrete or asphalt. Additionally, the use of such surfacing material as wire netting, plastic trackways, and metal sections has proven unsatisfactory in many respects. In an effort to resolve this problem an industrial firm, under contract with the US Marine Corps, has developed a product known as *ON-FAST*—a fiberglass filled with polyester resin—to be used as an expedient surfacing material.

The total *ON-FAST* system consists of fiberglass, a transporter, a manual spray unit, and three liquid components consisting of a polyester resin, a catalyst, and a promoter. To construct the surface, fiberglass mats are placed on the soil and sprayed with the liquid components by means of a manual spray unit. The spray unit has separate pumps for each of the three liquid components which are forced through two separate lines of equal capacity and out a hand-held double nozzle spray bar attached to the two lines by flexible hoses up to 50 feet in length. The material system can be applied at a rate exceeding 1,000 square feet per hour and is ready to use within 30 minutes after application.



Figure 11-7. Applying ON-FAST surface stabilizer. The manual spray unit and all materials may be transported by truck. Fiberglass mats are placed on a graded soil surface and sprayed with the liquid components. The material system can be applied at a rate exceeding 1,000 square feet per hour and is ready for use within 30 minutes after application. (Official US Navy photograph.)

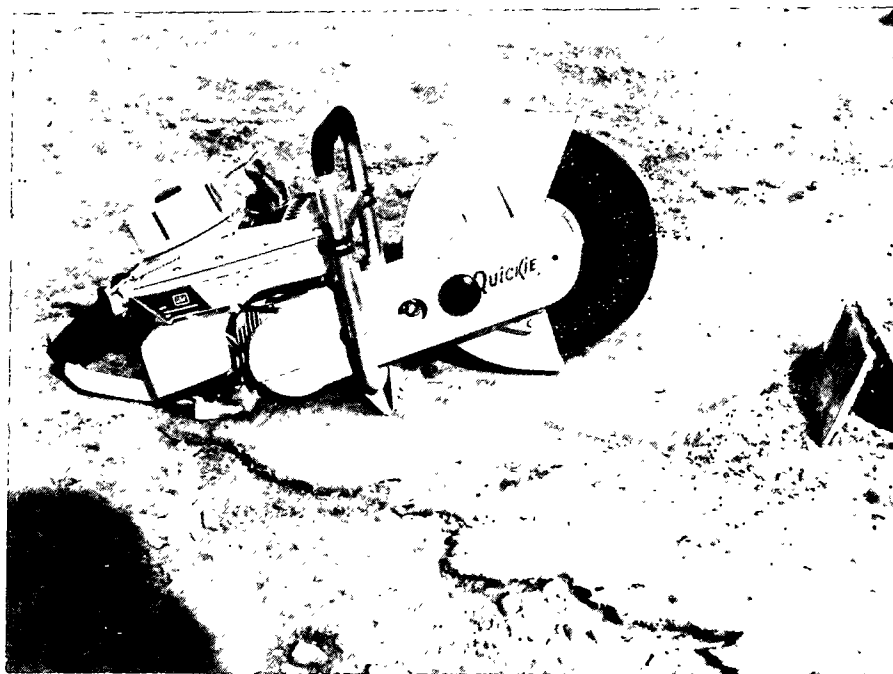


Figure 11-8. ON-FAST can be removed either by using a mobile power saw equipped with an extra-reinforced high speed abrasive blade to cut the surface material into pieces convenient to handle and haul away, or the material can be broken up by a tractor equipped with metal belts with cleats. (Official US Navy photograph.)

The ON-FAST system has been evaluated by the Naval Civil Engineering Laboratory with favorable results. Additional evaluation of the use of the ON-FAST system was made during the test exercise, Offshore Discharge of Container Ships (OSDOC II), conducted at Fort Story, Virginia, in October 1972. In this exercise, a

beach pad comprising 38,600 square feet of ON-FAST surfacing was used for truck/containerized cargo traffic and an area encompassing 29,870 square feet of ON-FAST surfacing was used as a traffic staging area. ON-FAST functioned exceptionally well in both instances.

11-9. Multipurpose Ship

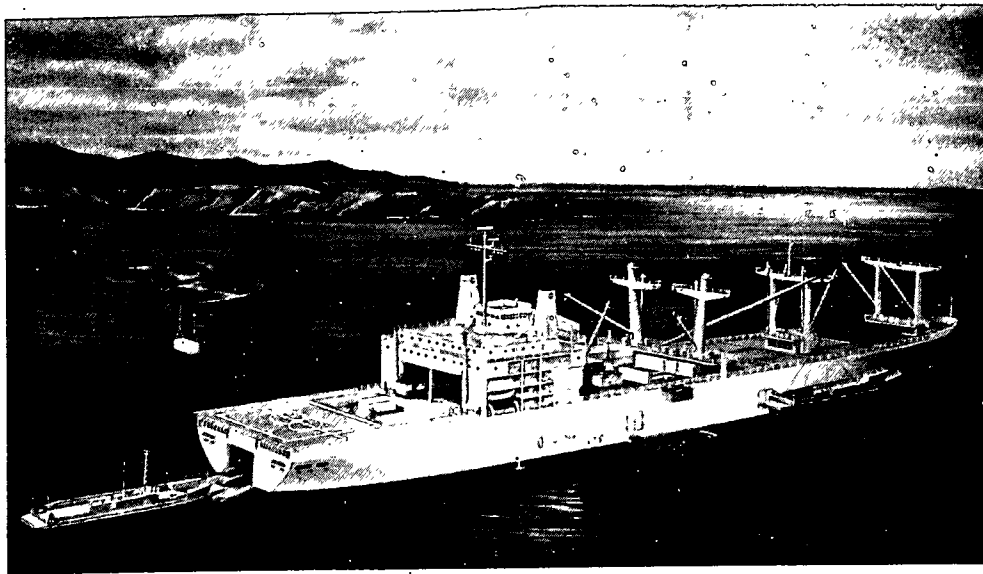


Figure 11-9. Artist's concept of the multipurpose ship. This ship can handle containers and roll-on/roll-off and break-bulk cargo. It can also handle heavy lift and outsize items, non-self-deployed aircraft, helicopter fly-on/fly-off, and LCU type landing craft. It is self-sustaining, having its own cargo handling gear. This sketch shows a track vehicle moving from the stern of the multipurpose ship onto a RORO vessel while an LCU class 1646 is being put over the side by the ship's 210-ton boom. Note also the heavy lift helicopter transporting a container of retrograde cargo from the shore to the ship's deck.

The proposed multipurpose ship is designed specifically to be self-sustaining in an emergency military environment and, at the same time, to retain the simplicity of the commercial cargo vessel. Its design has been generally accepted by the Army as most nearly meeting the criteria for transporting military cargo in support of worldwide contingencies.

Characteristics:

Has an overall length of 650 feet and a beam of 100 feet.

Cargo handling gear includes one 210-ton boom, eight 26-ton booms, and six 42-ton booms.

Draft is 28 feet (31 feet maximum).

Has hangar space to shelter two CH-54 helicopters or two heavy lift helicopters; a pad for helicopter flyaway; and deck space for vehicles, containers, or break-bulk cargo.

Capabilities:

Cargo capabilities include containers; RORO, break-bulk, and heavy lift cargo; non-self-deployed aircraft; helicopter fly-on/fly-off; and LCU type landing craft.

Can handle its own cargo, loading or discharging from either side or at the stern.

Can discharge smaller ships.

Has a capacity of 1,044 8x8x20-foot dry cargo containers.

Can carry four LCU's on deck.

Has 149,000 square feet of RORO area.

Has a dry cargo capacity of 2,015,000 cubic feet.

Can accommodate 80 8x8x40-foot refrigerated containers.

Has an endurance of 34,000 miles at 21.6 knots.

11-10. Advanced Container Management System

Large scale introduction of containers into a theater of operations requires movement management procedures that are fully responsive, that provide complete interface between the various elements of the system, and that provide adequate movement data and information on a realtime or near-realtime basis. These objectives will be achieved through implementation of a fully integrated automated container management system. Development of an automated system is proceeding under a project titled *integrated transportation management information system (ITMIS)*. The discussion that follows is in consonance with procedures under development in the ITMIS program. Basically, the system consists of—

A passive transponder type of tag or label.

An interrogation device that provides the power to energize the label and simultaneously receive the label data and transmit it.

A central computer file at the transportation command to store and produce container information as required.

The *tag or label* is the heart of the system with characteristics as follows:

It is envisioned as a piece of plastic within which is bonded microintegrated circuitry containing a 16-character (expandable to 32 characters) memory and circuits for modulation and transmission.

It has no battery or other power source within it.

It contains a device for receiving radiated power and for returning a signal.

It will be a low cost item and will last 5 to 10 years and undergo extremes of handling and weather.

The number of the label provides an address within the computer memory.

The *interrogation device* receives the signal from the label and forwards the signal to the central computer file. The primary configuration of the interrogation device may be either hand-held or a roadside/trackside version:

If hand-held, the interrogation device may be wired to a terminal device, or it may be self-contained. It will be used at general support and direct support supply activities, ocean and air terminals, and terminal transfer points to record movement of containers.

If a roadside/trackside device, it will not require monitoring or the presence of an operator, and may be placed at strategic points along the rail and highway net to record the passing of containers. It may also be placed at general support and direct support supply activities to record the arrival and departure of containers.

Within the theater, the *computer center* for movement management will be located at the transportation command (TRANSCOM), managed by the theater army TA movement control center (MCC), and operated by the automatic data processing unit organic to the TRANSCOM. Computers located at major terminals in the theater will provide input to and interface with the TRANSCOM computer center. Input/output devices will be spotted at various transportation movement offices throughout the theater and tied into this central file.

It is envisioned that a container consolidation point will be operated by each theater-oriented depot complex in CONUS. The control and documentation process begins when a pallet of cargo is prepared at one of the depots in the theater-oriented complex. Here pertinent *MILSTRIP* (military standard requisitioning and issue procedures) information (such as document numbers, commodity description, and Federal stock numbers) and *MILSTAMP* (military standard transportation and movement procedures) information (such as the transportation control number) are entered on punch-

cards or other input media.

A label (call it number 200 for discussion purposes) is selected at random and attached to the pallet. The punchcards are then read through a reader at the same time that the label is interrogated. The *MILSTRIP* and *MILSTAMP* information is forwarded together with the number of the label to the CONUS logistics control office where the documentation information for the items on the pallet is associated in the unified data file with label 200.

At the container consolidation point, a container also having a label number (call it number 50) receives pallet 200 together with other numbered pallets. A scanner on the loading dock records the entry of each numbered pallet into container number 50. All numbers for pallets inside the container will be associated with container number 50 throughout all legs of the container's movement. The association of pallet label numbers with container label number permits the computer to produce hard copy output of the container's contents in the form required (for example, bills of lading, transportation control and movement documents, manifests).

When container 50 is loaded aboard ship, a scanner reads the label and the lift and stow information is recorded in the terminal computer file. When loading is complete, the terminal computer has a complete record of each container loaded. The computer then produces a ship's manifest, and the manifest tape is transmitted to the theater central computer file.

Copies of the manifest are distributed to the senior terminal unit in the theater and to the TA MCC. The MCC gives a copy of the manifest to the materiel management center for determination of any required diversion or reassignment of container 50 or any of its numbered pallets. The MCC updates the central file to reflect any changes, advises TRANSCOM of the changes, and provides a copy of the corrected manifest to the terminal selected by the MCC for discharge of the carrier. The MCC also processes the manifest to develop the port clearance program and incorporates the result in the intratheater short range movement program.

The port determines which berth will be used and, when the ship arrives, dispatches an arrival notice to the MCC to update the theater central file. As container 50 is discharged from the vessel, a cargo checker from the terminal service company (container) working the ship utilizes a hand-held scanner to read the container label. The information is forwarded to the terminal com-

puter, which prepares documentation for the forward movement of the container. Meanwhile container 50 is pulled to the container marshaling yard, where a roadside scanner located at the entrance to the marshaling area records its entry to the yard and updates the master file.

Based on the intratheater movement program, the transport mode for container 50 is selected. Assume that the mode is rail and that final destination is a corps general support supply activity (GSSA). As the container is loaded aboard the railcar, a hand-held scanner records the loading process and updates the central file. As the railcar leaves the port, a trackside scanner records the departure of container 50 and updates the central file.

Rail movement of the container is monitored by trackside scanning devices located at key points along the rail network. Thus, if intransit action such as holding, diverting, or expediting is required, the MCC is able to query the computer for the location of the container.

Assume that the corps GSSA is not serviced by rail and that a transfer to motor transport is required. Based on the requirement forwarded from the TA MCC, a TRANSCOM transportation movement office (TMO) or the corps support command (COSCOM) MCC arranges for truck support. During transfer from rail to truck, the container label is read with a hand-held scanner and the resultant transfer data are read into the central file for updating purposes. As container 50 moves by truck to the corps GSSA, roadside scanners at critical point along the highway record the passage of the container and update the MCC file.

Should the container fail to arrive at a critical point within a predesignated time period, an exception report is produced by the computer. This alerts the MCC to initiate a tracer action with the carrier, using the last reported location of the container as a starting point for the tracing action.

The arrival of container 50 at the GSSA is recorded by a roadside scanner located at the GSSA entrance gate. As the pallets are unloaded from the container, a scanner at the GSSA loading point verifies the arrival of the container contents, including pallet number 200. After the container is unstowed, a card notifying the MCC that container 50 is empty is relayed through the local TMO. The MCC determines if a retrograde load is available for the container at its present or other location. If not, the container is returned empty to the terminal. Disposition instructions are provided through the TMO to the consignee and the mode operator.

As container 50 departs the consignee's location, a scanner queries the label and provides a depart destination report to update the MCC records. Intransit monitoring to the next destination, whether to load cargo or for retrograde movement out of the theater, is the same as for inbound movements. On retrograde movements, the theater movement management process is complete when the container is returned to the terminal and loaded aboard a vessel or aircraft outbound from the theater.

It should be noted that the advanced container management system is applicable to military and commercial containers used for intertheater and intratheater movement of cargo. However,—

Military owned or leased containers intended for special purpose use such as shelters, offices, and command posts or for longtime storage are monitored by transportation movement personnel only so long as they are in the transportation pipeline, and will be addressed as any other item of material. Once these containers are released to the consignee, they are removed from transportation accountability. A container approved by the TA MCC for use as temporary storage remains in the transportation system. When the temporary storage period (normally not to exceed 30 days) expires, the container reverts to use in the transportation system.

Specific *advantages* derived from the advanced container management system include—

Substantial reduction in documentation error rate. Since the TRANSCOM and terminal computers can prepare hard copy documentation, human error possibilities are significantly reduced.

Improved capacity for rapid transportation response to supply requirements. With container data immediately available to MCC personnel, there is a significant improvement in effective response times for changing requirements.

Reduced manpower requirements. Although precise figures cannot be determined at this time, a reduction in documentation and movement control personnel may be anticipated.

Provision for in-transit visibility of containers and their cargo. The matching of container label number with pallet label number produces a readout of the container contents. Scanners located at key points throughout the theater enable movement personnel to monitor container locations in the transportation pipeline.

11-11. Summary

The requirements for rapid movement of containerized cargo and for improved system responsiveness (and related in-transit visibility of assets) generate an urgent requirement for new

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and/or improved equipment and procedures to successfully carry out transportation container operations as envisioned for support of the Army in the field. Primary considerations for development in these areas currently include—

A heavy lift helicopter (HLH) capable of externally lifting and transporting the fully loaded 20-foot MILVAN container—the HLH will provide high speed lighterage for discharging and backloading containers between the deck of a container ship and container marshaling areas, terminal transfer points, direct support and general support supply activities and, if required, users.

A shipboard container lifting device to be used in conjunction with non-self-sustaining container ships in a logistics over-the-shore (LOTS) environment to lift cargo containers from ship cells to deck level for pickup by helicopter and to supplement other LOTS discharge systems.

A flat-decked air cushion vehicle (ACV) having a payload capability of 25 to 30 short tons—the ACV, if adopted by the Army, will provide high speed lighterage for discharging and backloading container ships in LOTS operations.

A conceptual wheeled hydrofoil amphibious lighter that can self-load, transport over the beach, and self-offload containers and diversified cargo weighing up to 60 short tons.

A 300-long-ton beach discharge lighter—a conceptual trans-hydro craft that will satisfy the Army requirement for a self-propelled beaching craft to transport MILVAN's and other containers, as well as roll-on/roll-off and break-bulk cargo and heavy or outsize items, primarily in LOTS operations.

Improved causeway and floating pier equipment that will provide a more flexible and rapid means for moving containers and vehicles between ship and shore—this requirement may be satisfied by existing commercial equipment. The equipment would serve as a—

Floating working pier at container ship side or at the beach site.

Self-propelled or towed floating platform for movement of containers from the ship to the shore handling facilities.

Floating causeway extending from an off-shore platform to the beach.

A capability for rapid surface stabilization such as is needed in beach areas, container transfer and storage areas, equipment operation and parking areas, and helicopter pads—a commercial product, ON-FAST, has been tested with gratifying results by the US Navy and was used by the ARMY during the 1972 OSD OC II test exercise, where it performed most satisfactorily.

A conceptual multipurpose ship designed to be self-sustaining in an emergency military environment—it can self-load or self-discharge its cargo, and its capabilities include containers; roll-on/roll-off, break-bulk, and heavy lift cargo; non-self-deployed aircraft; helicopter fly-on/fly-off; and LCU type landing craft.

An integrated automated container management system—development of an automated system is proceeding under a project titled integrated transportation management information system (ITMIS). Basically, the system consists of transponder type of tag or label, a device to trigger the electronic label, and an interrogation device to receive and transmit the label signal to a central computer file at the transportation command. On-line input/output devices will tie appropriate activities (for example, transportation movement offices) into the central data file. The system will permit transportation movement personnel to monitor and identify the container and its location throughout its movement in the transportation pipeline.

★ CHAPTER 12 HAZARDOUS MATERIALS

12-1. Hazardous Materials and Safety

Safety is the keynote in hazardous materials operations. Before operating personnel can *safely* (and correctly) package, document, label, handle, transport, or stow hazardous military cargo, they must be familiar with—

- Principal characteristics of the cargo (for example, nature of the hazard, compatibility with other commodities, and sensitivity to heat, moisture, jarring or dropping, etc.).
- Identification and warning markings (that is, labeling, placarding, tagging).
- Regulations pertaining to the commodity and its transportation.

12-2. Training Requirements

Although all transportation personnel should be knowledgeable in the area of hazardous material, those who are directly involved in its handling, movement, and stowage require extensive training, particularly in hazards involved, handling and stowing procedures, labeling and placarding, and proper action in case of accident or damage to container and/or contents. Such key people include, but are not necessarily limited to—

- Supervisory personnel
- Crane operators
- Materials handling equipment operators
- Cargo checkers
- Cargo handlers
- Yard transporter operators
- Local and line haul operators

12-3. Publications and Regulations

Hazardous materials operations in an overseas theater are governed by rules, regulations, and policies established by the theater commander (as affected by host/allied nation requirements). On occasion, overseas directives and procedures reflect and parallel those of the continental United States (CONUS). For that reason, material in this chapter is in consonance with the following:

- AR 55-355, Military Traffic Management Regulation
- DOD Regulation 4500.32-R, Military Standard Transportation and Movement Procedures (MILSTAMP)
- Joint military publication, AFM 71-4/DSAM 4145.3/TM 38-250/NAVSUP PUB 505/MCO

P4030.19A, Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft

- US Coast Guard (USCG) Pamphlet Number 108, Rules and Regulations for Military Explosives and Hazardous Munitions
- CFR (Code of Federal Regulations) Title 46, Part 146.29, Detailed Regulations Governing the Transportation of Military Explosives and Hazardous Munitions on Board Vessels (USCG, Department of Transportation (DOT))
- CFR Title 49 (DOT), Parts 100-199
 - Parts 170-189 (rail, air, water, and highway transportation)
 - Part 397, Motor Carrier Safety (Federal Highway Administration)
- CFR Title 42, Part 71, Etiologic Agents
- Inter-Governmental Maritime Consultative Organization (IMCO), International Maritime Dangerous Goods Code
- International Air Transport Association (IATA) Restricted Articles Regulations
- International Maritime Dangerous Goods Code (IMDGC)

Note: CFR's may be purchased from—
Superintendent of Documents
US Government Printing Office
Washington, DC 20402

CG 108 may be requisitioned from—
Commandant
US Coast Guard
ATTN: CGAS-2/71
400 7th Street, NW
Washington, DC 20590

12-4. Hazardous Materials Classification and Class Designations

In the interest of safety, the Department of Transportation (DOT) and other Federal regulatory agencies (para 12-3) have established detailed requirements governing the marking, handling, and shipment of hazardous cargo moving in interstate and intertheater traffic. Shipment of hazardous cargo by the military services must conform with the rules and regulations of these regulatory agencies.

To permit ready identification of hazardous cargo, a distinct colored label has been designed for each of 17 hazardous commodity "classifications" (cargo that requires a hazardous material label is often referred to as "label cargo").

Hazardous materials class numbers are required by most foreign governments and by Department of Defense (DOD). The labels may be over stamped or overprinted with the appropriate hazard class number located in the bottom corner of the label. United Nations (UN) class numbers and commodity numbers are required on Military Standard Transportation and Movement Procedures (MILSTAMP) documentation.

DOT classifications and United Nations numerical class designations are shown below:

<i>DOT classification</i>	<i>UN numerical class designations</i>
• Class A explosives	1
• Class B explosives	1
• Class C explosives	1
• Flammable gas	2
• Nonflammable gas	2
• Flammable liquid	3
• Flammable solid	4.1
• Spontaneously combustible	4.2
• Dangerous when wet	4.3
• Oxidizer	5.1
• Organic peroxide	5.2
• Poison A*	2 or 6
• Poison B	6
• Irritating material	6
• Etiologic agent	6
• Radioactive materials	7
• Corrosive material	8
• Other regulated materials (ORM)**	9

*Class 2 consists of gases; class 6 consists of liquids or solids

**Some ORM may not fall in UN class 9, but in some other UN class.

12-5. Hazardous Materials Definitions

The following definitions have been abstracted from the Code of Federal Regulations, Title 49—Transportation, Parts 100-199. Refer to the referenced sections for complete details.

Note. Rulemaking proposals are outstanding or are contemplated concerning some of these definitions.

• **Explosives**—Any chemical compound, mixture or device the primary or common purpose of which is to function by explosion; that is, with substantially instantaneous release of gas or heat, unless such compound, mixture, or device is otherwise specifically classified in Parts 170-89. (Sec. 173.50)

—Class A—Detonating or otherwise of maximum hazard. There are nine types of class A explosives all defined in Section 173.53.

—Class B—In general, function by rapid combustion rather than detonation and include some explosive devices such as special fireworks, flash powder, etc. Flammable hazard. (Sec. 173.88)

—Class C—Certain types of manufactured ar-

ticles containing class A or class B explosives, or both, as components but in restricted quantities, and certain types of fireworks. Minimum hazard (Sec. 173.100)

• **Flammable liquid**—Any liquid having a flash point below 100° F (37.8° C) as determined by tests prescribed in Section 173.115(d).

—Pyroforic liquid—Any liquid that ignites spontaneously in dry or moist air at or below 130° F. (Sec. 173.115(c))

• **Combustible liquid**—Any liquid having a flash point at or above 100° F (37.8° C), and below 200° F (93.3° C). (Sec. 173.115(b))

• **Flammable solid**—Any solid material other than one classed as an explosive which, under conditions normally incident to transportation, is likely to cause fires through friction, retained heat from manufacturing or processing, or which can be ignited readily and which, when ignited, burns so vigorously and persistently as to create a serious transportation hazard. (Sec. 173.150)

• **Spontaneously combustible**—A solid substance (including sludges and pastes) which may undergo spontaneous heating or self-ignition under conditions normally incident to transportation or which, upon contact with the atmosphere, may undergo an increase in temperature and ignite. (Sec. 171.8)

• **Dangerous when wet (water reactive material)**—Any solid substance (including sludges and pastes) which, by interaction with water, is likely to become spontaneously flammable or to give off flammable or toxic gases in dangerous quantities. (Sec. 171.8)

• **Oxidizer**—A substance such as a chlorate, permanganate, inorganic peroxide, nitro carbo nitrate or a nitrate that readily yields oxygen to stimulate the combustion of organic matter. (Sec. 173.151)

• **Organic peroxide**—An organic compound containing the bivalent “-O-O-” structure, and which may be considered a derivative of hydrogen peroxide where one or more of the hydrogen atoms have been replaced by organic radicals. (Sec. 173.151a)

• **Corrosive material**—A liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or, in the case of leakage from its packaging, a liquid that has a severe corrosion rate on steel. (See Sec. 173.240(a)(1) and (a)(2) for details.)

• **Compressed gas**—Any material or mixture having in the container pressure exceeding 40 psi at 70° F or having an absolute pressure exceeding 104 psi at 130° F. (Sec. 173.300(a))

• **Flammable gas**—Any flammable material or mixture having in the container a pressure exceeding 40 psi at 100° F. (Sec. 173.300)

- **Nonflammable gas**—Any compressed gas not meeting the definition of a flammable gas.

- **Poisons:**

- A**—Extremely dangerous poisons. Poisonous gases or liquids of such nature that a very small amount of the gas, or vapor of the liquid, mixed with air is dangerous to life. (Sec. 173.326)

- B**—Less dangerous poisons. Substances, liquids or solids (including pastes and semisolid), other than poison A or irritating material, which are known to be so toxic to man as to afford a hazard to health during transportation; or which, in the absence of adequate data on human toxicity, are presumed to be toxic to man. (Sec. 173.343)

- Irritating material** (formerly poison C)—A liquid or solid substance which upon contact with fire or when exposed to air gives off dangerous or intensely irritating fumes, but not including any poison A. (Sec. 173.381)

- **Etiologic agent**—A viable micro-organism or its toxin which causes or may cause human disease. (Sec. 173.386) (Refer to the Department of Health, Education, and Welfare Regulations Title 42, CFR, Sec. 72.25(c) for details.)

- **Radioactive material**—Any material, or combination of materials, that spontaneously emits ionizing radiation, and having a specific activity greater than 0.002 microcuries per gram. (Sec. 173.389) *Note:* See Sec. 173.389(a) through (1) for details.

The following is offered as a working definition only as this material is not presently defined in Title 49:

- **Cryogenic material**—Extremely low temperature gaseous material transported as a liquid. Maintained in liquid form by low temperature rather than pressure.

12-6. Characteristics of Hazardous Materials

Following is a summary of the principal characteristics of hazardous materials by class:

- **Class A explosives**—Generally speaking, class A explosives may be sensitive to such things as exposure to sparks, flame, or extreme temperatures, or to dropping (in some cases, dropping as little a distance as 4 to 10 inches).

- **Class B explosives**—These are particularly sensitive to sparks and flame.

- **Class C explosives**—This class is sensitive to sparks and flame.

- **Flammable gas, nonflammable gas, and poison gas**—Gases which should be stored in a cool, ventilated area away from fire hazards, sources of heat, ignition, or sparks. If the gas is toxic or anaesthetic, gas masks or respirators should be available for use. Handling personnel must be in-

structed that jarring, dropping, or rough handling of compressed gas is extremely dangerous.

- **Flammable liquids**—These should be stored in a cool, well-ventilated area, away from sunlight, sources of heat, flames, sparks, combustible materials, and oxidizers and organic peroxides. If the flammable liquid is either corrosive or toxic, rubber gloves, goggles, aprons, and gas masks or respirators should be available as appropriate.

- **Flammable solid, spontaneously combustible, and dangerous when wet**—Classifications which include any solid material, other than one classified as explosive, that is likely to cause fires through friction, absorption of moisture, spontaneous chemical changes, retained heat from manufacturing or processing, or that can be ignited readily and, when ignited, burns so vigorously and persistently that it creates a serious transportation hazard. These compounds should be stored in a cool, well-ventilated area away from sparking devices, heat, flame, high temperatures, oxidizers, and organic peroxides.

- **Oxidizers and organic peroxides**—Any compound which readily yields oxygen to stimulate the combustion of organic matter. These chemicals present dangerous fire and explosion hazards when in contact with organic or other oxidizable materials. Oxidizers and organic peroxides should be stored in a cool, well-ventilated area away from moisture, fire hazard, flame, and organic or other oxidizable materials. Drums containing these compounds may be tiered provided that each tier is separated by means of wooden boards.

- **Poison A**—Poisonous liquids (or gases) of such nature that a very small amount is dangerous to life. Poisons should be stored in cool, well-ventilated areas away from fire hazards. Protective clothing, equipment, and first aid supplies should be available in storage and working areas. Personnel should have available and, as appropriate, wear or employ the items prescribed by service directives for the poisons and conditions involved. Storage and working areas should be conspicuously marked with appropriate placards.

- **Poison B**—Liquids or solids (including pastes and semisolids) other than poison A that are known to be a health hazard during transportation or that, based on laboratory tests conducted on animals, are presumed to be toxic to man. Handling measures and safety precautions are essentially the same as for poison A.

- **Irritating material**—Because these materials are irritating to the skin and respiratory system, personnel in the working or storage area should have gas-tight chemical safety goggles and respirators available. Materials should be stored in a cool, well-ventilated area.

- **Etiologic agent**—An etiologic agent is a causative agent for infectious diseases as described by the US Public Health Service (USPHS) Surgeon General or the US Department of Agriculture (USDA). Many agents are sensitive to temperature changes and must be maintained refrigerated or frozen. (See 42 CFR 71.25, Etiologic Agents, for handling and shipping procedures.) If factors of public relations, security, or expeditious handling indicate a requirement, the shipment should be accompanied by technical escorts, security escorts, military guards, or other qualified personnel.

- **Radioactive materials**—The possibility of exposure of personnel to radiation is an ever present and critical hazard in the handling of radioactive materials. Surveillance of personnel exposed to these materials is a responsibility of the medical facility. Any operation that involves the storage, handling, packaging, or shipment of radioactive materials is brought to the attention of the local medical facility in order that personnel who may be exposed to ionizing radiation may be properly monitored. (See AR's 40-13, 40-14, 55-55, 700-52, 700-64, and 755-15. Also, see TM 3-261; Title 10 of CFR, chapter 1, part 71; and US Nuclear Regulatory Commission's Regulatory Guides 7.2, 7.3, 7.4, and 7.5.)

- **Corrosive material**—The primary hazard from corrosive material is the corrosive effect on humans and other materials. Certain of the corrosives (particularly when fuming or vaporized) damage the eyes, lungs, and mucous membrane; others may burn the skin, causing lesions and sores; still others, when in contact with metal or to air in the presence of moisture, may release such gases as hydrogen (a fire and explosion hazard) or hydrogen chloride (very toxic). Generally speaking, corrosive materials should be stored in a cool, dry, well-ventilated, isolated area away from fire hazards, open flames, oxidizers, and organic peroxides. Use CO₂, CB₄, or dry chemicals to fight fire. Chemical safety goggles, respirators or gas masks, and other protective equipment and clothing should be available for use.

TM 38-250 and IMCO provide a comprehensive discussion of the principal hazardous materials in each class, to include such areas as—

- Properties
- Storage and handling
- Packaging
- Safety precautions
- Protective clothing or equipment requirements

CG 108 and 46 CFR Part 146.29, Rules and Regulations for Military Explosives and Hazardous Muni-

tions, provide detailed information concerning compatibility of various classes of military explosives and hazardous munitions. TM 38-250, pages A1 and A3, note compatibility for military aircraft.

Table 12-1 shows compatibility characteristics of military explosives and hazardous munitions.

Table 12-2 shows stowage compatibility of different hazardous materials by water.

Table 12-3 shows loading and storage chart of hazardous materials for land transportation.

12-7. Hazardous Cargo Labels

Each item of hazardous cargo must be identified by an appropriate international shipping label. These labels are of a standard size, shape, and color and bear an easily recognizable symbol that indicates the content of the container. The shipper is responsible that hazardous cargo is properly labeled. The labels are procured from commercial sources.

Except for the rectangular-shaped "Biomedical Material" label (and two labels (refer to fig F-13) still required for certain commodities shipped by air), hazardous cargo labels are diamond-shaped with distinct markings and color combinations.

Except for the two labels referenced above for air shipment (fig F-13), the same labels may be used for both surface and air transport of hazardous materials.

Hazardous cargo labels are illustrated in figures F-1 through F-14, appendix F.

Note. In addition to the appropriate label(s), air shipments of hazardous material require a DD Form 1387-2, Special Handling Data/Certification. This form and instructions for its completion are addressed in TM 38-250 and MILSTAMP.

General guidelines concerning use of labels are outlined below:

- Shipper must furnish and attach appropriate label(s) to each package of hazardous material offered for shipment unless exempted from labeling requirements. (Title 49, CFR, Sec. 172.400)

- If the material in a package has more than one hazard classification, one of which is class A explosives, poison A, or radioactive materials, the package must be labeled for each hazard class. (Title 49, CFR, Sec. 172.402(a)) Each package containing a material classed as a flammable liquid, flammable solid, or oxidizer and meeting the definition of a poison B must be labeled as required for both classifications. (See Title 49 CFR, part 172.402(a)(2).)

Table 12-1. Compatibility Chart for Military Explosives and Hazardous Munitions (extracted from CG 108)

I.C.C. class		Class	I	II-A	II-B	II-C	II-D	II-E	II-F	II-G	II-H	II-J	III	IV	V	VI	VII	VIII	IX-A	IX-B	IX-C	X-A	X-B	X-C	X-D	X-E	XI-A	XI-B	XI-C	XI-D	Class	
C	Small arms ammunition w/o explosive bullets, mechanical time fuze and like items	I	□	□	□	□	□	□	□	□	•	D	□	□	□	□	□	□	□	□	□	□	H	•	•	•			•	•	I	
B	Bulk propellants, such as ballistite, cordite, FNH, NH, and NC powder, "Made-up bag charges" in outside shipping containers	II-A	□	□	□	•	•	•	•	•	•	•	•	□	□	•	□	•	□	•	•	•	•	•	•	•	C	C	•	•	II-A	
B	Fixed ammunition w/o explosive projectiles and like items	II-B	□	□	□	□	•	□	B	•	•	D	□	□	□	□	□	•	□	•	•	•	H	•	•	•	•	□	•	•	II-B	
B or C	Pyrotechnics (fireworks)	II-C	□	•	□	□	•	□	A	•	•	D	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	II-C	
*Var	Chemical ammunition—WP or "WP" filled (solid)	II-D	□	•	•	•	□	□	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	II-D	
*Var.	Chemical ammunition—HC filled (solid)	II-E	□	•	□	□	□	□	A	□	•	•	□	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	II-E	
*Var.	Chemical ammunition—FS or FM filled smoke (liquid)	II-F	□	•	B	A	•	A	□	A	•	•	A	B	B	•	B	•	•	•	•	•	•	•	•	•	□	□	•	•	II-F	
*Var	Chemical ammunition—IM, NP, or PT filled, incendiary composition (oil gel)	II-G	□	•	•	•	•	□	A	□	•	D	•	•	•	•	•	•	•	•	•	•	•	•	•	•	□	□	•	•	II-G	
None	Chemical ammunition—water activated	II-H	•	•	•	•	•	•	•	•	□	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	II-H	
*Var.	Chemical ammunition—TH filled incendiary composition (solid)	II-J	D	•	D	D	•	•	•	D	•	□	•	D	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	II-J	
B or C	Fuzes, PD w/o booster; fuzes AT mine (nonchemical) w/o booster; fuzes, bomb tail w/o booster; fuzes, tracer; primers; primer detonators, etc.	III	□	•	□	•	•	□	A	•	•	•	□	□	□	□	•	□	•	•	•	•	•	•	•	•	•	•	•	•	III	
A	Fixed and semifixed ammunition with explosive loaded projectile	IV	□	□	□	•	•	•	B	•	•	D	□	□	□	□	□	•	•	•	•	•	H	•	•	•	□	•	•	•	IV	
A	Separate loading projectiles filled with explosive "D"	V	□	□	□	•	•	•	B	•	•	•	□	□	□	□	□	•	•	•	•	E	•	•	•	•	□	•	•	•	V	
A	BD fuzes; PD fuzes with booster; bomb fuzes with booster; rocket fuzes with booster; and like items	VI	□	•	□	•	•	•	•	•	•	•	□	□	□	□	•	□	•	•	•	•	•	•	•	•	•	•	•	•	VI	
A	Separate loading proj. filled with HE other than explosive "D"	VII	□	□	□	•	•	•	B	•	•	•	□	□	□	□	□	•	•	•	•	E	•	H	•	•	□	•	•	•	VII	
A or C	Blasting caps; detonators; AT mine fuzes (chemical); etc.	VIII	□	•	•	•	•	•	•	•	•	•	□	•	•	□	•	□	•	•	•	•	•	•	•	•	•	•	•	•	•	VIII
A or B	Explosives in bulk, such as black powder, propellant explosives for small arms, etc.	IX-A	□	□	□	•	•	•	•	•	•	•	•	•	•	•	•	•	□	•	•	•	•	•	•	•	•	•	•	•	IX-A	
A	High explosives, such as dynamite, TNT, demolition blocks, etc.	IX-B	□	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	□	•	□	•	•	•	•	•	•	•	•	IX-B	
A	Initiating and priming explosives in bulk	IX-C	□	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	□	•	•	•	•	•	•	•	•	•	•	IX-C	
A	Explosive bombs, mines, torpedoes, etc.	X-A	□	•	•	•	•	•	•	•	•	•	•	•	E	•	E	•	□	•	□	□	•	•	•	•	•	•	•	•	X-A	
A	Explosive bombs, mines, etc., packed with fuze in integral package	X-B	H	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	□	□	□	•	•	•	•	•	•	•	•	X-B	
A	Guided missiles with solid propellant motors, w. w/o HE warhead	X-C	•	•	H	•	•	•	•	•	•	•	•	H	•	•	H	•	•	•	•	•	□	•	•	•	•	•	•	•	X-C	
A	Guided missiles with liquid petroleum fueled propellant motors, HE warhead	X-D	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	□	•	•	•	•	•	•	X-D	
A	Rocket engines, liquid	X-E	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	□	•	•	•	•	•	X-E	
A or Pois. A	Chemical ammunition—lethal	XI-A	□	C	•	•	•	□	□	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	□	□	•	•	XI-A	
A or Pois. C	Chemical ammunition—nonlethal	XI-B	□	C	□	•	•	□	□	•	•	•	□	□	•	□	•	□	•	•	•	•	•	•	•	□	□	•	•	•	XI-B	
*Var.	Fuels in containers for missile and rocket engines	XI-C	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	•	XI-C	
*Var.	Oxidizers in containers for missile and rocket engines	XI-D	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	F	XI-D	

Legend: •—Refers to different ICC classes: F, L., F. G., Cor. L., Oxy. M., etc.

□—Shall not be stowed together.

□—May be stowed together

For A, B, C, D, E, F, G, and H, refer to paragraph 146.29-99 of CG108 for proper stowage (reference Code of Federal Regulations (CFR) 46, paragraph 146.29-99, and other portions of CFR 46 to assure compatibility and to preclude conflicts).

Use of Chart Following is an example of how to read the above chart: To determine if pyrotechnics (fireworks) (class II-C) is compatible with initiating and priming explosives in bulk (class IX-C), read from "pyrotechnics" horizontally to the intersection with vertical column headed "IX-C." The black dot at the intersection of the horizontal and vertical lines shows that the two classes "shall not be stowed together."

Table 12-2. Stowage Compatibility of Different Hazardous Materials by Water

		1	2(a)	2(b)	3	4(a)	4(b)	4(c)	5(a)	5(b)	6	7	8	9
Explosives.....	1	(*)	4	2	4	4	4	4	4	4	2	2	4	0
Flammable compressed gases	2(a)	4	—	0	2	1	2	1	2	4	0	2	1	0
Nonflammable compressed gases.....	2(b)	2	0	—	2	0	1	0	0	2	0	1	0	0
Flammable or combustible liquids.....	3	4	2	2	—	2	2	2	2	3	0	2	1	0
Flammable solids.....	4(a)	4	1	0	2	—	1	1	1	2	0	2	1	0
Flammable solids labeled spontaneously combustible.	4(b)	4	2	1	2	1	—	1	2	2	0	2	1	0
Flammable solids labeled dangerous when wet.....	4(c)	4	1	0	2	1	1	—	2	2	0	2	1	0
Oxidizers.....	5(a)	4	2	0	2	1	2	2	—	2	1	1	2	0
Organic peroxides.....	5(b)	4	4	2	3	2	2	2	2	—	1	2	2	0
Poison A or poison B or irritating materials.....	6	2	0	0	0	0	0	0	1	1	—	0	0	0
Radioactive materials.....	7	2	2	1	2	2	2	2	1	2	0	—	2	0
Corrosive materials.....	8	4	1	0	1	1	1	1	2	2	0	2	—	0
Other regulated (ORM) materials.....	9	0	0	0	0	0	0	0	0	0	0	0	0	—

Degree of required separation: The table specifies the minimum separation requirements that apply when transporting different classes of hazardous materials on board a vessel, other than a ferry vessel. The symbols used in the table mean the following: "1"—away from; "2"—separated from; "3"—separated by a complete cargo compartment or hold from; "4"—separated longitudinally by an intervening complete cargo compartment or hold from; "0"—no general segregation specified (individual entries in the Hazardous Material Table in 172.101 of Title 49); "*"—consult revised Table I of CFR for segregation requirements between different explosives.

- When two or more hazardous materials of different classes are packed within the same packaging or outer enclosure, the outside of the package must be labeled for each material involved. (Title 49, CFR, Sec. 172.404)

- Radioactive materials requiring labeling must be labeled on two opposite sides of the package. (Title 49, CFR, Sec. 172.403(f))

- Labels should be applied to that part of the package bearing the name of contents as required by subpart D of 172. (Title 49, CFR, Sec. 172.406(a))

Guidelines concerning export and import shipments are outlined below:

- Export shipments—Exporters are advised that shipments by water or air to foreign destinations may be rejected for transportation if they bear warning labels other than those illustrated in appendix F, since many countries are implementing labeling requirements conforming to the United Nations recommendations.

- Import shipments—Labels having the same size, color, and symbols as prescribed by Title 49 affixed to packages in another country are authorized for shipments in the United States. They may contain inscriptions required by the country of origin. (Title 49, CFR, Sec. 171.12(b))

Note. The section numbers and references shown above are found in the Code of Federal Regulations, CFR Title 49—Transportation, Parts 100-199. The same references may be found

Illustration of use of this table: Problem: Determine compatibility of flammable compressed gases (2(a)) with organic peroxides (5(b)). Read across horizontal column "2(a)" until you intersect vertical column "5(b)." The number at the intersection is "4." Referring to the paragraph above (degree of required separation), the number 4 indicates that the two commodities must be "separated longitudinally by an intervening complete cargo compartment or hold."

in the following publications which also contain a reprint of Title 49 CFR Parts 100-199:

R. M. Graziano's Tariff (Bureau of Explosives)

ATA (American Trucking Association) Dangerous Articles Tariff

12-8. Placarding for Transport by Motor

Motor vehicles transporting hazardous cargo by highway must bear an appropriate placard, as shown in figures F-15 through F-31 (app F). The placards are in addition to the hazardous labels discussed above and are placed on front, back, and both sides of the container or transporter. ReflectORIZED placards are recommended for vehicles transporting explosives A or explosives B. In an overseas theater, the host nation may require either its card be used, or a bilingual card used. (See 49 CFR, part 172. 504 and 172.506.)

Regulations governing use of placards in an overseas theater are based essentially on regulations and directives for transport of hazardous cargo in CONUS. However, there may be variations because of theater policies and/or host nation requirements.

Hazardous cargo placards for highway are illustrated in figures F-15 through F-31, appendix F, along with the cargo type and minimum quantities that require use of placards. These placards become mandatory on 1 July 1977. Placards may be purchased from commercial sources. However, placards

Table 12-3. Loading and Storage Chart of Hazardous Materials for Land Transportation

The following table shows the hazardous materials which must not be loaded or stored together.

The letter X at an intersection of horizontal and vertical columns shows that these articles must not be loaded or stored together, for example: Detonating fuzes class A, with or without radioactive components in horizontal column must not be loaded or stored with high explosives or propellant explosives, class A in vertical column.

The following table shows the hazardous materials which must not be loaded or stored together.																							
The letter X at an intersection of horizontal and vertical columns shows that these articles must not be loaded or stored together, for example: Detonating fuzes class A, with or without radioactive components g horizontal column must not be loaded or stored with high explosives or propellant explosives, class A b vertical column.																							

Table 12-3. Loading and Storage Chart of Hazardous Materials for Land Transportation—Continued

The following table shows the hazardous materials which must not be loaded or stored together.

The letter X at an intersection of horizontal and vertical columns shows that these articles must not be loaded or stored together, for example: Detonating fuzes class A, with or without radioactive components g horizontal column must not be loaded or stored with high explosives, or propellant explosives, class A b vertical column.

	a	b	c	d	e	f	g	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Explosive projectiles, bombs, torpedoes, or mines, rifle or hand grenades (explosive), jet thrust units (jato), explosive, class A, or igniters, jet thrust (jato), explosive, class A *	(f)	...	X	X	...	...	X	...	...	X	...	...	...	...	...	X	X	X	X	X	X	X
Detonating fuzes, class A, with or without radioactive components	(e)	X	X	...	X	X	...	...	...	X	...	...	...	...	...	X	X	X	X	X	X	X
CLASS B EXPLOSIVES																						
Ammunition for cannon with empty, inert-loaded or solid projectiles, or without projectiles, or rocket ammunition with empty projectiles, inert-loaded or solid projectiles or without projectiles	1	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	...	X	...
Propellant explosives, class B, jet thrust units (jato), class B, igniters, jet thrust (jato), class B, or starter cartridges, jet engine, class B	2	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	X	...	X	...
Fireworks, special or railway torpedoes	3	X	X	X	X	X	X	...	...	...	...	...	...	...	...	...	...	...	...	...	X	...
CLASS C EXPLOSIVES																						
Small arms ammunition, or cartridges, practice ammunition	4	...	X	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

are normally fabricated locally in an overseas theater.

Note. This also holds true for rail and air transport placards.

12-9. Placarding for Rail Transport

Rail cars are also placarded as shown in figures F-15 through F-31, appendix F. Placards are applied to both ends and both sides of the car. In an overseas theater, placarding may be modified by theater policies and/or host nation requirements, and may be in two or more languages. (See 49 CFR 172.504 and 172.508.)

12-10. Placarding for Air Transport

Although certain commercial aircraft can carry the American National Standards Institute/International Organization for Standardization (ANSI/ISO) 40-foot container (chap 2), it is not recommended that 40-footers be considered in planning. This is due primarily to the limited availability to the Army of aircraft having the capability to accommodate 40-footers.

Because of the relatively high tare weight of the 20-foot container (which reduces payload accordingly), the 20-footer is normally moved by Air Force aircraft only on an emergency or high priority basis.

When parked in other than a designated restricted, posted, and traffic-controlled explosive parking area, aircraft containing (as cargo) DOT class A and/or class B explosives, or other regulated dangerous materials must have appropriate placards as outlined below (or as required by theater or host nation policies). Placards—

- Are displayed in a conspicuous manner covering all approach angles, to warn taxiing aircraft and vehicular or pedestrian traffic, and to assist firefighting activities.
- Can be temporarily affixed to the aircraft (removed before flight), or fastened to portable stands provided it creates no ground or taxiing safety hazard.

The labels illustrated in figures F-1 through F-14, appendix F, may be used in air transport of hazardous cargo.

12-11. Placarding for Water Transport

Any amount of a hazardous material loaded in a container (SEAVAN) for loading aboard a vessel must be placarded prior to receipt at the marine terminal. (See 49 CFR, part 172.512, Freight Container Placarding Table.) Use the same placards as for motor transport.

12-12. Segregation of Hazardous Materials

In the interest of safety, hazardous materials operations at water terminals, air terminals, and other shipment and transshipment points are normally isolated from operations that involve other types of cargo. This holds true for loading and unloading operations, stowing and unstowing operations, and in-transit storage (marshaling) areas, etc.

Size and location of hazardous materials handling and storage areas depend upon availability of terminal space; volume, types, and compatibility of hazardous cargo to be handled; and dispersal requirements within the area (as set forth in quantity-distance standards table 31, TM 9-1300-206).

Note that cargo checkers, cargo handlers, and marshaling area equipment operators must know the location of designated holding areas for label cargo, and must insure that those commodities are directed to the proper area as they are received in the terminal.

12-13. Guidelines for Containerizing Hazardous Materials

Note. As used here, the term container is synonymous with the term MILVAN/SEAVAN.

- Before stowing hazardous material in a container, be sure the container is clean, dry, and undamaged. Damaged containers should be rejected.
- Containers in which hazardous material is stowed should be inspected in transit for external evidence of damage and leakage or shifting of contents. Damaged containers are repaired or replaced. Leaking or shifting packages are removed from the container.
- Incompatible hazardous materials may not be stowed in the same container.
- Packages in containers marked "This side up" must be so stowed.
- Hazardous cargo must be braced and secured as prescribed in Title 49 CFR 100-199. Packages in the container must be braced and immobilized so that there is a minimum likelihood of damage to contents or fittings during transit.
- When hazardous material forms only part of the container load, it should be stowed so as to be readily accessible from the container door.
- Before packages are stowed, they should be inspected for damage and for proper marking and labeling.
- Containers bearing hazardous cargo must be appropriately placarded (app F). Four placards are placed externally, one on each side and one on the front and the rear.

- After hazardous cargo is removed from the container, labels must be removed from the container. (See 49 CFR, part 172.401.)

12-14. Inspection of Hazardous Materials and Equipment

To prevent movement of unsafe explosives or chemicals, the material must be inspected and segregated under supervision of competent ammunition inspectors. Particular attention should be directed to cargo that has been exposed to weather and, as a result, may be corroded, deteriorated, or leaking.

Retrograde material such as vehicles, weapons, salvaged empty projectiles, cartridges, cartridge cases (and other such supplies and equipment that are likely or suspected to have been explosive loaded or contaminated) must be individually inspected by the shipper prior to shipment.

As prescribed in AR 740-20, a Materiel Inspection Tag is affixed by the shipper to show that the item or shipment has been inspected, and that all explosives have been removed. The terminal commander will refuse to accept a shipment without shipper certification.

12-15. General Safety Measures

- Establish a safety program (AR 385-10) for the loading, unloading, and handling of hazardous materials. Make sure that each person involved in the operation is familiar with its contents.

- Provide qualified supervisors for direction and control of the loading, unloading, and handling of hazardous materials. Supervisors must thoroughly understand the hazards involved, and will indoctrinate personnel under them as to special precautions and to emergency situations that may arise.

- Designate a specific segregated area(s) for container restowing activities if available.

- Designate specific segregated areas for in-transit storage purposes.

- Mark hazardous materials operating and storage areas with appropriate warning signs.

- When appropriate, initiate security measures for prevention of theft, sabotage, etc.

- When handling explosives or flammable materials—

- Prohibit smoking except in established smoking areas; provide facilities for safe disposal of smoking materials.

- Prohibit the introduction of matches, lighters, or other sparking or open-flame producing items into the hazardous area.

- Prohibit footwear strengthened with nails or other spark-producing metal, unless the footwear is covered with rubber, leather, or other nonsparking material.

- Establish firefighting and other emergency plans, and provide for firefighting and other emergency equipment.

- In handling explosives, avoid jars or shocks (particularly with sensitive explosives used in detonators). Nuclear weapons should be subjected to minimum handling and minimum exposure to shock.

- Assure that protective clothing and/or equipment is used during handling of toxic oxidizers, fuels, or chemical agents. This may include masks, goggles, gloves, or outer garments. Suitable neutralizing agents should be available for personnel handling toxic gases, etiologic agents, and white phosphorus.

- Keep personnel clear of loads being lifted by terminal or marshaling yard equipment.

- Keep roadways and marshaling yard aisles in good repair to minimize the danger of toppling container-bearing transporters.

12-16. Transport of Hazardous Materials by Highway

Because the transportation of ammunition, explosives, flammables, chemical agents, and radioactive materials is dangerous, it is essential that personnel involved know and observe applicable safety regulations.

- A vehicle transporting class A or B ammunition, explosives, or other hazardous material is inspected at—

- The origin of shipment, at which time deficiencies are corrected prior to entry of the transporter into a sensitive area.

- At trailer transfer points (when prime movers are exchanged).

- At destination, before delivery is accepted.

In CONUS, the inspector uses DD Form 626, Motor Vehicle Inspection (TM 55-310), as a guide to and record of the inspection. In an overseas theater, DD Form 626 (modified appropriately) may be used, or it may serve as a model for a locally produced inspection form.

- In CONUS, military shippers use DD Form 836, Special Instruction for Motor Vehicle Drivers (TM 55-310), for instructions to drivers of military and commercial vehicles transporting dangerous material. Sections of the form outline actions to be taken in case of fire, accident, and breakdown, and provide for entry of specific information by the shipper or transportation officer. This form (appropri-

ately modified) may also be used in an oversea theater, or it may serve as a model for a locally produced instruction form. The driver must have shipping papers available at all times. (See 49 CFR 177.817.)

- In CONUS, military vehicles transporting ammunition, flammable materials, or toxic chemicals must comply with DOT regulations governing highway movement of these materials. In an oversea theater, such movement must comply with theater policies and host nation requirements.

- Follow the general safety guidelines below for motor transport of ammunition and explosives:

- To prevent accidental movement of the transporter while it is being loaded or unloaded, stop the engine, place the vehicle in gear, and set the handbrake (if appropriate, also block the wheels).

- Do not jar or shock; handle the explosives with care.

- Prohibit smoking within 50 feet of a transporter loaded with explosives or flammable liquids (no smoking by driver during transport).

- Prohibit open flames (such as matches, cigarette lighters, torches, etc.) within 100 feet of a transporter loaded with explosives or flammable liquids.

- Each truck hauling explosives or flammables must have two fire extinguishers, one inside the truck cab and one outside on the driver's side. Assure that drivers understand how to check serviceability of extinguishers and how to use them.

- Vehicles will be driven at a safe distance from other traffic, and drivers should be cautioned against sudden stops or turns.

- Vehicles will be clearly labeled or placarded to warn other traffic (app F).

- During highway movement of chemical agents, hazardous chemicals, and chemical ammunition, the driver should have a protective mask, protective clothing, and appropriate protective and first aid items (for example, burn ointment), as necessary.

- The driver must be aware of the hazardous nature of his cargo (for example, symptoms produced by toxic chemical agents) and of action to take in case of fire, spillage, or other emergency.

12-17. Transport of Hazardous Materials by Rail

Containerized hazardous material moving by rail is subjected to constant vibration, pounding, and side sway, along with the shock of abrupt starts and stops. For this reason, container stowing and handling procedures are especially critical to the

prevention of cargo shifting during movement and the attendant possible—

- Damage to cargo, container, and/or rail equipment.
- Explosion, fire, or release of toxic material.
- Injury or death to personnel.

As discussed in chapter 2, a number of Army-owned 20-foot MILVAN's (numbers 5630 and above) have been equipped with an internal mechanical load bracing system (approved by the Association of American Railroads (AAR) and the US Coast Guard (USCG)) for the movement of containerized ammunition. Additionally, the Army has developed an ammunition restraining kit for commercial containers. This item has also been approved by the AAR and the USCG (AAR approval is required for rail movement in CONUS).

Note. Because of the stringent stowing standards established by the AAR, containerized hazardous material acceptable for rail movement is also acceptable for highway movement.

In CONUS, compliance with standards established by the AAR for rail movement of containerized hazardous materials is mandatory. In an oversea theater, these standards, although not mandatory, serve as excellent guidelines for bracing and blocking hazardous material in containers, and for securing containers and trailers to flatcars.

Illustrations of methods for loading and bracing shipments of explosives and other hazardous articles by trailer-on-flatcar (TOFC) or container-on-flatcar (COFC) may be obtained by writing—

Association of American Railroads
1920 L Street, NW
Washington, DC 20036

12-18. Transport of Hazardous Materials by Military Air

- Air Force aircraft—The US Air Force is responsible for, and coordinates with other services in movement of hazardous material by Air Force aircraft. This area is covered in detail in AFM 71-4/DSAM 4145.3/TM 38-250/NAVSUP PUB 505/MCO P4030.19, Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft.

- Army aircraft—The assault support and the heavy helicopter may be used in a theater of operations to deliver limited quantities of ammunition or other hazardous cargo, normally when delivery by other modes cannot meet mission requirements. Because helicopter maximum lift capacity is approximately 12 short tons, the cargo is not normally containerized, but placed on pallets and slung external-

ly. Normal safety measures apply to handling procedures.

12-19. Water Terminal Guidelines

Loading and stowage of military explosives and other hazardous cargo aboard merchant vessels fall under the jurisdiction of the USCG. The USCG publication, CG 108, Rules and Regulations for Military Explosives and Hazardous Munitions, contains the special requirements governing transportation of military explosives on board vessels. Key provisions of the regulation include the following:

- The authority for enforcement of CG 108 is vested in the Coast Guard, who will make an inspector available. Additionally, in the case of Army or Air Force cargo:

- An ordnance inspector will advise concerning safe handling and stowage of explosives.

- A chemical representative will advise concerning hazardous chemical items.

- Because a number of the propellants used in modern missile systems are composed of chemicals not in general use, legal rules and regulations for moving them have not yet been published. Special request must be made to the Coast Guard for information on how to move such materials. Technically qualified personnel must be present to advise concerning safe handling.

- The loading terminal must submit to the USCG captain of the port in CONUS (or the port commander overseas) a written request for permission to load military explosives and hazardous munitions and a prestowage plan. (The loading pier or anchorage must be specified at this time.)

- Loading cannot begin until the approving authority approves the request and the prestowage plan. (If cargo is to move on a Military Sealift Command (MSC) ship or MSC-chartered ship, a representative of MSC must also approve the plan.)

- The ship's master is responsible that proper stowage and segregation of hazardous cargo aboard the ship is in consonance with the provisions of CG 108. However, because the terminal prepares a prestowage plan (and subsequently, a final stowage plan), terminal personnel must also be familiar with the provisions of those regulations. The terminal is also required to prepare a dangerous cargo manifest. (See CFR 49, 176.30.)

- Measures to prevent movement of unsafe explosives or chemicals, and related equipment are as discussed in paragraph 12-14.

- Containers should be restowed only in specifically designated areas, properly posted and secured.

- Fire prevention and protection measures

should be established as spelled out in 49 CFR, parts 176.57-176.79.

- Security measures should provide for strict accountability for hazardous materials and protection against pilferage, theft, and sabotage.

12-20. Air Terminal Guidelines

TM 38-250 provides a detailed discussion of air terminal (and in flight) procedures to be followed in transporting hazardous materials by Air Force aircraft.

Safety practices and handling procedures discussed in this chapter are generally applicable to movement of hazardous materials by Army helicopter. However, one additional point, peculiar to helicopter transport and critical to safety, is stressed here:

- Hazardous materials transported by helicopter are normally externally sling-loaded. In an in-flight emergency, it may be necessary to jettison the load. For this reason, the flight pattern must avoid populated and congested areas where at all possible.

12-21. Summary

- The central theme of hazardous materials procedures is safety of operations.

- Essential to safety of operations is a thorough understanding of the hazards involved and the procedures established to minimize or eliminate those hazards.

- Hazardous materials are grouped by Department of Transportation into 17 hazard classifications and, by United Nations classifications, into nine numerical class designations. Each classification or group is made up of hazardous materials having generally the same or similar characteristics and properties, and posing essentially the same or closely related hazards.

- The several governmental regulatory agencies have established rules and regulations concerning packaging, labeling, segregating, stowing, handling, and storage of hazardous materials in CONUS, and the movement of hazardous materials between CONUS and overseas theaters. As appropriate, and within parameters prescribed by host or allied nations, theater commanders have established hazardous materials regulations and policies that are in consonance with those of CONUS.

- Shipping papers must be prepared for all hazardous cargo moving in the transportation system.

- Hazardous materials are transported by all modes (water, highway, rail, and air). Transporta-

tion cargo handlers, cargo checkers, mode operators, and supervisory personnel must be familiar with and comply with applicable regulations and directives.

- Transportation personnel prepare cargo pre-stowage and stowage plans for hazardous material to be transported by ocean vessel. They also handle containerized hazardous material in terminals and marshaling areas, provide temporary in-transit storage, and, when required, remove cargo from unserviceable containers and restow it. For these reasons, they must be familiar with packaging and labeling requirements, and with compatibility char-

acteristics and requirements for segregation.

- Dangerous cargo manifests must be prepared for all hazardous cargo moving by water.

- Loading and stowage of military explosives aboard merchant vessels falls under jurisdiction of the USCG.

- CG 108, Rules and Regulations for Military Explosives and Hazardous Munitions, governs transportation of military explosives on board vessels.

- Representatives of the US Coast Guard, and ordnance and chemical inspectors are available to inspect and advise as necessary.

APPENDIX B

STOWING CARGO IN CONTAINERS

B-1. Introduction

Shipping activities, distribution and consolidation activities, and others are required to stow and unstow containers for and during movement of containerized cargo. This appendix is intended as guidance for personnel engaged in stowing and unstowing activities and generally follows policies and procedures developed by the Military Traffic Management and Terminal Services (MTMTS).¹

B-2. Stowing Objective

The objective of a container stowing operation is to facilitate delivery of cargo to the consignee in an undamaged condition and in a configuration that can be efficiently and economically unstowed. To accomplish this, the shipper must be aware of the forces encountered during shipment, especially during ocean transit. The shipper also must be aware of the theater's transportation and handling capabilities and of the consignee's facilities and capability to handle containers and unitized modules. The Army in the field will be on the receiving end of the majority of containers. It is the responsibility of CONUS or offshore shippers to stow cargo in containers to accommodate the receiver.

B-3. Preparation for Stowing

First of all, *select the right container* for the commodity to be shipped. Considerations to be observed in selecting the container include the physical characteristics of the item being shipped, restrictions at receiving facilities, perishability of items, securing devices required, and cube and weight of shipment.

After selecting the container, *inspect it for cuts, holes, or severe dents*—any of which could permit water to enter. Other things to be watched for include faulty hinges or doors, broken reflectors, or damaged lifting eyes. Holes in the roof, floor, or sides or damaged doors call for rejection of the container. TM 55-8115-200-24 should be referred to for criteria to be applied in acceptance and inspection of MILVAN's for stowing and for carrying out required repairs.

Plan the container load so that heavy material generally goes on the bottom of the container and light material on top, with the weight distribution equalized both transversely and longitudinally. Items of irregular shape and high density which will not make a uniform bottom layer should be interspersed in the bottom of the container for proper weight distribution and the load planned around them.

Plan to obtain optimum cube utilization of various length containers. Generally, as container length decreases, optimum cargo density increases. The average density range of cargo loads for dry cargo containers that yield optimum cube utilization of various length containers is shown below:

Standard container sizes (feet)	100 % cube utilization (pounds per cubic foot)	80 % cube utilization (pounds per cubic foot)
8x8 1/2 x 35	21.5	26.9
8x8x40	26.3	32.8
8x8x30	28.8	36.0
8x8 1/2 x 24	31.1	38.9
8x8x20	40.4	50.5
8x8x10	44.9	56.1

To provide adequate protection for container contents and still achieve the maximum economy offered by containerization, the *contents should be packaged to the appropriate level* but not overpackaged. Generally, old-style expensive export packaging can be eliminated, but domestic packaging is usually inadequate. Especially subject to damage is the containerized multiconsignee shipment of inadequately packaged cargo *that does not move unopened* from loading point to destination.

B-4. Stowing Guidelines

Following is a discussion of some of the principal guidelines, as developed from experience, to be observed when stowing cargo in containers:

Unitize cargo whenever feasible. Unitizing makes for more rapid stowing, provides more stable loads within a container, makes it easier to secure cargo, and—above all—facilitates unstowing by the receiver.

¹ MTMTS Pamphlet 55-2, Guidelines for Stuffing Containers, 1 April 1970.

UNITIZED LOADS

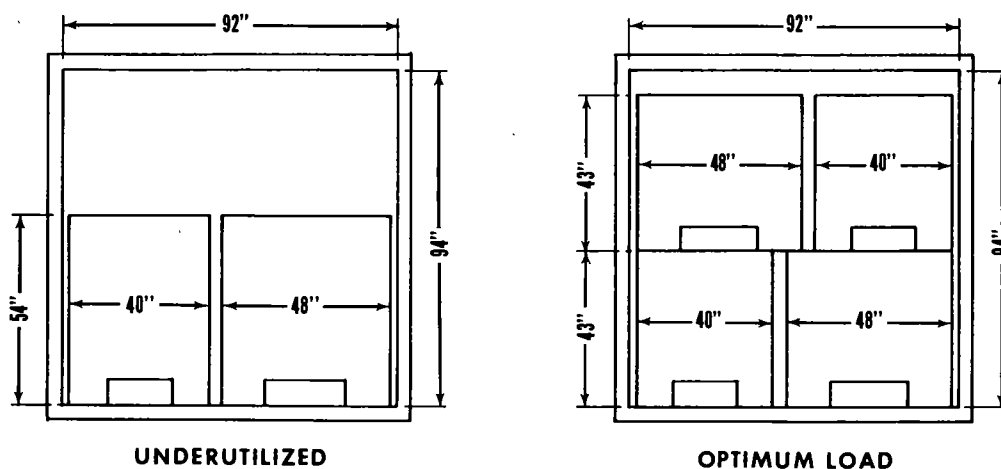


Figure B-1. For optimum cube utilization, unitized loads should be double-tiered. As shown on the right, standard 43-inch-high palletized units may be stacked in two tiers in most containers. Note in the left portion of the figure that use of 54-inch-high pallets prevents full utilization of the container.

Strive for maximum cube utilization, but not at the expense of the consignee. Although tight packing is necessary for optimum cube utilization and to prevent load shifting, cargo must not be so tightly packed that it cannot be unloaded. Six to eight inches (or more if required) of head space must be left between the top of the load and the container roof to permit a forklift to work the loads.

Weigh cargo carefully, particularly when discharge by helicopter is anticipated. For helicopter lift, each item of cargo should be weighed and marked individually before it is placed in the container. The gross weight of the container must be clearly marked on the sides of the container and must not exceed the design lift capacity of the aircraft to be employed.

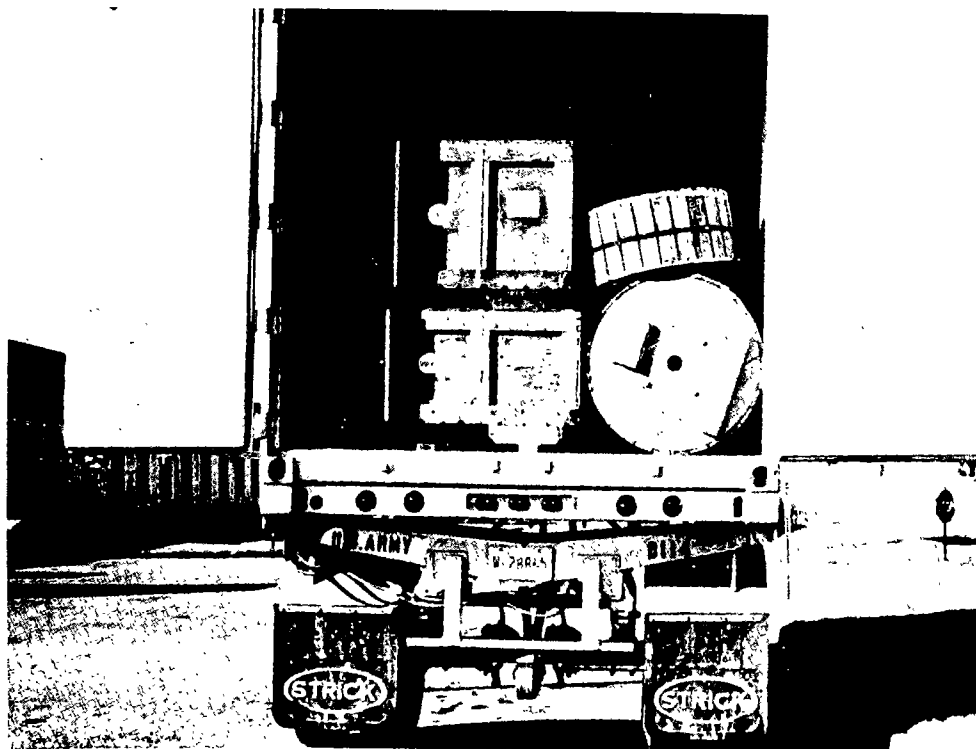


Figure B-2. Because this container is poorly packed, its contents can be expected to arrive at the overseas destination in a severely damaged condition. Additionally, the container will probably be damaged by the shifting of its cargo.

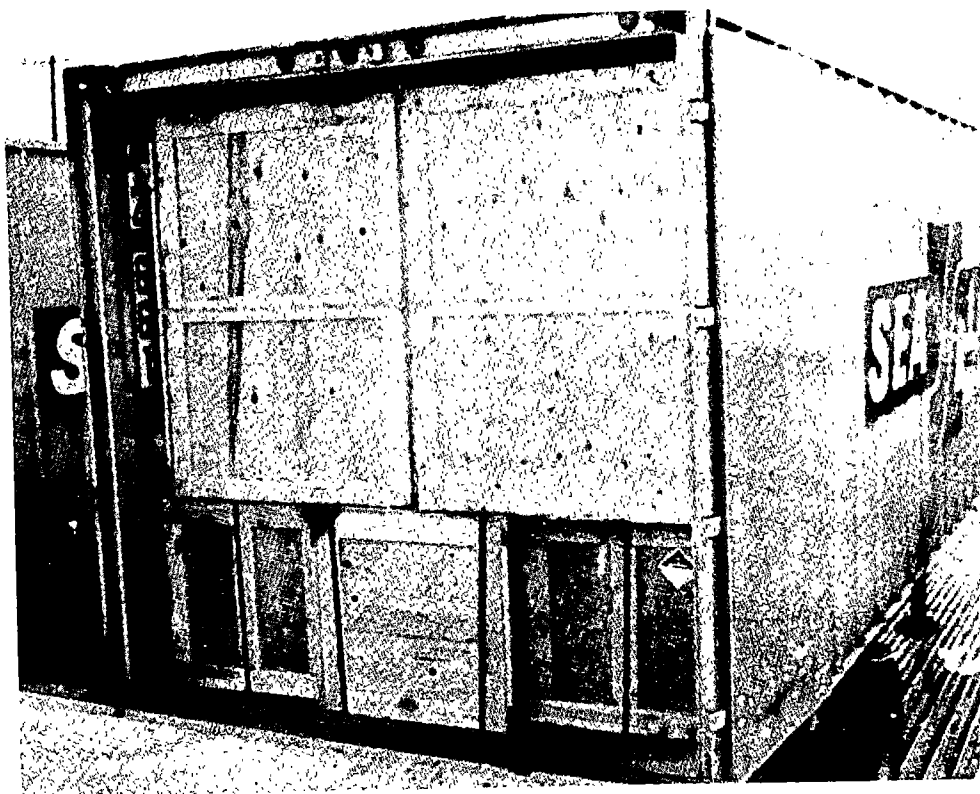


Figure B-3. This container is packed too tightly, leaving no head space for unstowing by forklift. Additionally, there are no skids under the boxes nor bottom openings for insertion of forklift tines. The consignee will have a difficult time unstowing this container.

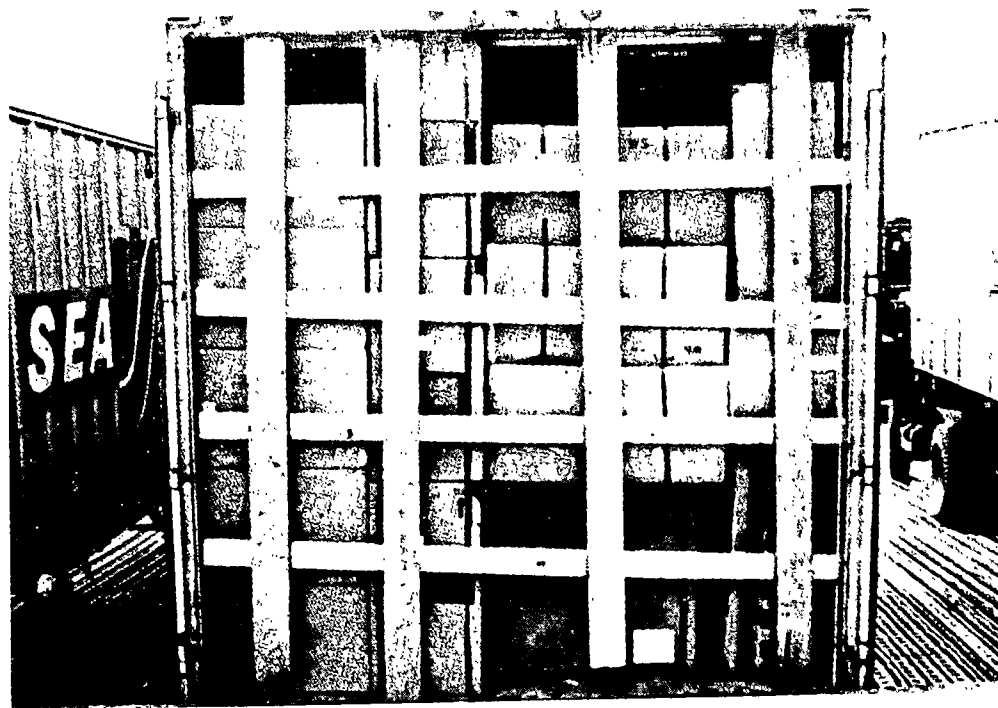


Figure B-4. Cargo in this container is properly stowed for good space utilization and is braced and blocked to prevent shifting. Space has been left at the top of the load to permit use of a low-mast forklift in unstowing the container.

Distribute the load evenly, with the heavy items on the bottom. This lowers the center of gravity, protects light and delicate items, and may eliminate the need for separators. If the standard 43-inch-high unitized load is used, the units can be double-tiered in most containers. Even distribution of cargo within the container is especially critical when employing helicopters for discharge, especially for helicopters capable of other than single point attachment.

Distribute weight evenly over the floor of the container. The general rule for stowing correctly—that is, using all available floor space with the weight distributed as evenly as possible—is as applicable with containers as with any type of trailer. Containers are designed to carry specified weights spread evenly over the entire floor area. For heavy cargo with a relatively small base, measures must be taken to distribute the weight evenly by use of dunnage or by securing the item on a skid or pallet type base that is larger than the item base.

When possible, consolidate cargo in one container for one consignee. This permits throughput and eliminates intermediate break-bulk points. If more than one consignee's materiel is being shipped in one container, separation of each consignee's items facilitates breakout and reshipment.

Load only compatible cargo in any one container. Careful attention must be given when stowing containers with varied commodities to insure that these commodities are compatible. Physical characteristics of cargo—such as weight, size, and density and whether cargo is liquid or solid—must be considered. Certain types of cargo can be contaminated or tainted by contact with oil, dust, or vapors. Types of cargo requiring varying temperatures should not be packaged in the same container.

Separate dry and liquid cargo. When liquids in

cans and dry cargo are stuffed in the same container, the cans should not be stored above the dry cargo because of the hazards of leakage. The dry cargo should either be placed above the liquid or on the same level, and both should be raised off the floor with dunnage. Leaks frequently occur in barrels or drums because of movement during shipment.

Secure loads in containers to prevent movement horizontally, longitudinally, and vertically. Various types of dunnage and blocking such as lumber, burlap, cardboard, or paper should be used when required to fill voids and prevent shifting of cargo during transit. Some containers have various types of mechanical restraining devices for securing cargo, and some have vertical bulkheads, horizontal bulkheads, or completely retractable bulkheads built in for special purposes. Doorway protection is required to eliminate shifting of cargo and damage to doors.

Stowing perishables in refrigerated containers presents a different problem from the stowing of general cargo. The object of refrigeration is to keep the commodity at a temperature which will maximize its life and maintain quality. All fresh fruits and vegetables are living things even though separated from vine, tree, or soil and they continue to generate heat, the amount generated varying with the item and its temperature. Refrigeration is used to counteract this organic generation of heat in addition to removing the heat produced by ambient conditions. Fresh perishable commodities should be stowed in a fashion to permit free circulation of cool or cold air throughout the whole load. Frozen foods, on the other hand, do not generate heat, and stowing boxes and cartons tightly in a refrigerated container will prevent heat entry and refrigeration will keep the items surrounded with a blanket of cold air.

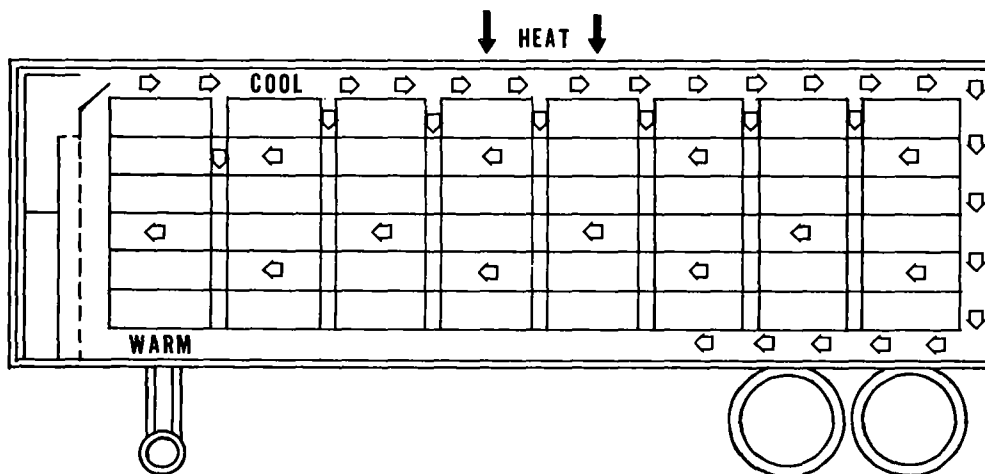


Figure B-5. Fresh fruits and vegetables are heat-generating cargo. Therefore, cartons must be stacked with openings throughout the load to permit free circulation of refrigerated air.

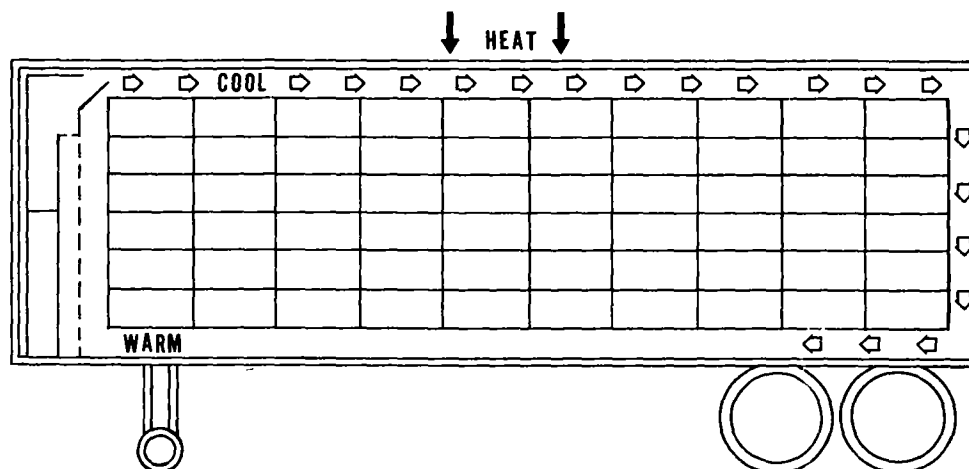


Figure B-6. Since frozen foods do not generate heat, packages should be packed tightly together in a solid compact mass. No requirement exists for ventilation channels in the interior of the load; however, there should be ventilation around the load with at least a 10-inch clearance between the top of the load and the roof of the container.

B-5. Hazardous Cargo

Hazardous materials or dangerous cargo includes materiel that may be classed as explosives, radioactive materials, poisons, flammable liquids or solids, corrosives, irritants, and compressed gases. Handling and transporting dangerous or hazardous cargo must be in compliance with appropriate regulations listed in annex I to this appendix.

Close supervision is required during the

stowing process to make sure that cargo is accurately identified and actually placed in the container. Ammunition and other military explosives will be loaded into containers in accordance with procedural drawings specifically approved by the US Coast Guard and US Army Materiel Command. A chapter covering the shipping of dangerous and hazardous material in containers will be published at a later date.

ANNEX I TO APPENDIX B

REGULATIONS APPLICABLE TO THE TRANSPORTATION OF

DANGEROUS OR HAZARDOUS MATERIAL

DOD Regulation 4500.32-R, Military Standard Transportation and Movement Procedures (MILSTAMP)

AR 55-55, Transportation of Radioactive and Fissile Materials

AR 55-56, Transportation of Dangerous or Hazardous Chemical Materials

AR 55-228, Transportation by Water of Explosives and Hazardous Cargo

AR 55-355 (Chapter 216), Military Traffic Management Regulation (NAV-SUPINST 4600.70/AFM 75-2/MCO P4600.14A/DSAR 4500.3)

AR 70-44, DOD Engineering for Transportability (OPNAVINST 4600.22A, AFR 80-18, MCO 4610.14B, DSAR 4500.25)

AR 220-10, Preparation for Oversea Movement of Units (POM)

TM 38-250, Packaging and Materials Handling: Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft (AFM 71-4, NAVSUP Pub 505, MCO P4030.19C, DSAM 4145.3)

Code of Federal Regulations, 14CFR, Federal Aviation Administration, Part 103, Transportation of Dangerous Articles and Magnetized Materials

46CFR, Coast Guard, Department of Transportation; Part 146, Transportation or Storage of Explosives or Other Dangerous Articles or Substances, and Combustible Liquids Aboard Vessels

49CFR, Department of Transportation, Chapter 1, Hazardous Materials Regulations Board, Parts 171-179

APPENDIX C

SECURITY

C-1. Security Considerations

The possibility of pilferage from containers or theft of entire containers must be considered during all phases of shipment.

- *In-transit security.* Pilferage from containers or theft of containers may occur regardless of the mode of transportation. Methods of security include use of guards, escort vehicles, aerial observation, sensors, and tamperproof locking devices and tiedown material.

- *Storage security.* In addition to the use of a guard force, sensors, tamperproof locking devices and distinctive markings, storage security of containers includes use of the following:

Close supervision during container stowing process—make sure cargo is accurately identified and actually placed in the container.

Positive control over documentation.

Control of individuals and vehicles within storage areas.

Periodic inspection and search of containers.

Periodic searches of personnel who handle supplies.

Continuous observation of loading and unloading procedures.

Proper positioning of containers for ready identification.

Adequate lighting and fencing.

Proper storage with container door against a wall or other partition or with container door against container door.

When it is determined that a container has been stolen or diverted for unauthorized use, an immediate report should be made to the nearest military police element indicating date of loss of the container and its contents, last known location, destination, and other pertinent data.

C-2. Security of Classified Material

Classified cargo should not be mixed with

commodities susceptible to pilferage.

When classified and protected material is shipped by container—

The provisions of AR 55-355 and other policies separately established by the Army as a shipper service will be followed. Specified transportation protective measures and methods of shipments will be applied.

C-3. Military Police Physical Security Company

The increase of cargo volume in terminal areas resulting from large scale containerization will frequently necessitate a commensurate increase in physical security measures and/or augmentation of available security forces. The military police physical security company (TOE 19-97) should be considered as a potential augmentation force by terminal commanders.

Mission:

- Provides physical security forces for terminal service operations when assigned the mission by the theater army TA military police brigade commander.

Capabilities:

At level 1, the military police physical security company can—

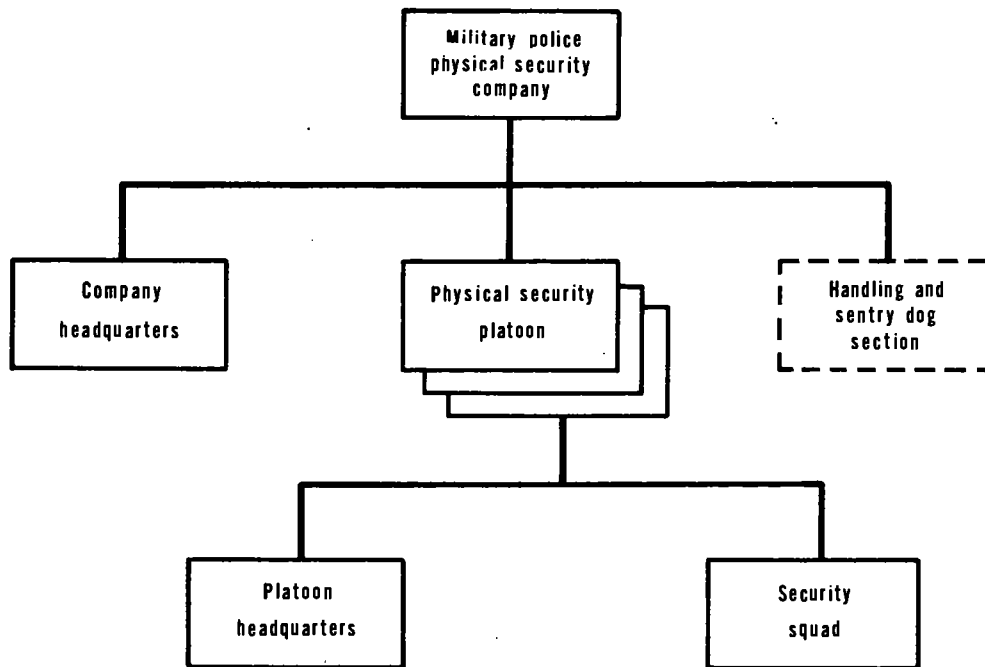
- Establish a maximum of nine motor patrols and 24 physical security posts over a 24-hour period when the three organic physical security platoons are engaged in no other duties.

- Employ 15 dog patrols to enhance security of facilities if required by local conditions.

Assignment:

Can be provided by the TA military police brigade based on established need.

Organization:



--- Included in Part II, SRC 19097720 only

Figure C-1. Organizational chart for the military police physical security company (TOE 19-97).

Operations:

- Conducts physical security surveys to evaluate the adequacy of existing safeguards and to determine the protection necessary for sensitive or critical materiel and supplies.
- Controls the circulation of individuals in and around secured terminal areas, to include the regulation of movement into and out of the areas.

- Provides close-in physical security for special ammunition systems and classified or sensitive supplies, both in transit or static.
- Provides local and internal security for sensitive logistical facilities, to include the operation of specialized physical security devices.

APPENDIX D

MAINTENANCE OF CONTAINERS

Stowing and unstowing units perform organizational maintenance on Army containers as prescribed in *TM 55 9115-200-24*. Units in the transportation system perform emergency repair of containers as described below. Container maintenance beyond user capability is performed by direct support maintenance activities.

GUIDELINES

1. When a commercial tractor is pulling a commercial container, the commercial operator is responsible for maintenance of the container.
2. When a military tractor is pulling a commercial container, the Army may make emergency repair required to get the container back to the commercial operator.
3. Emergency repair of Army-owned containers can be performed by transportation units.

WHAT

Emergency repair of Army-owned containers is limited to the capability of assigned maintenance personnel and includes—

1. Visual inspection of exterior
2. Repair of sheet metal panels when the damage would otherwise preclude the movement of containers forward
3. Repair of door assemblies when the damage would otherwise preclude the movement of containers forward

WHO

Emergency repair of Army-owned containers is accomplished by—

1. *Container equipment maintenance platoon* of the transportation terminal service company (container)
 2. *Equipment platoon* of the transportation terminal transfer company
 3. *Maintenance section* of the transportation medium truck company (limited repair of refrigerator units is available from the 30-variation of this unit)
-

APPENDIX E

STANAG 2023

**MARKING OF MILITARY CARGO FOR INTERNATIONAL MOVEMENT
BY ALL INTERNATIONAL MEANS OF TRANSPORT**

RESERVATIONS

- UNITED STATES: 1. Whenever NATO cargo is entered into or moved through the United States transport systems, including the Defence Transportation System (DTS), all markings and marking requirements will conform strictly to the provisions of MILSTAMP and MIL-STD-129.
2. Point of balance markings for the United States are to be designated by the words "centre of balance" in lieu of the letters "C. G."

DETAILS OF AGREEMENT (DofA)
MARKING OF MILITARY CARGO FOR INTERNATIONAL MOVEMENT
BY ALL INTERNATIONAL MEANS OF TRANSPORT

Annexes: A(DofA). Location of Marks on Containers.
B(DofA). Handling and Storage Instructions (Not attached—still under preparation).

AGREEMENT

1. The NATO Armed Forces have agreed to standardize:

- a. Movement Marks (Annex A(DofA)).
- b. Handling and Storage Instructions (Annex B(DofA)). On consignments of military cargo for international movement by all international means of transport, except where the move is national in character and is handled exclusively by that nation's means of transport.

PRINCIPLES

2. The principles followed in this STANAG, and which will apply to subsequent amendments and supplements, are as follows:

- a. Subject to over-riding security considerations, the system of markings should be the same in peace as in war.
- b. The system must comply, insofar as practicable, with commercial requirements.
- c. Existing international and NATO Standardization Agreements should be observed where obligatory, and made use of where practicable, in preference to devising new standards, symbols, etc.
- d. The STANAG concerns those marks which are essential information to personnel handling cargo in transit. Other marks of distinct national interest are permitted insofar as they do not detract from the clarity of the essential markings.
- e. All marks should be made in BLACK except where another colour will provide greater clarity or is specifically prescribed.
- f. All marks should be simple so that they can be readily applied to a consignment and easily recognized for sorting purposes.
- g. In the case of air-dropped supplies, the provisions of STANAG 3427 regarding the colour identification code will apply.
- h. Measurements are expressed in the metric system, and if these are not the normal units of the consignor or consignee, in feet and inches also. They are to be rounded up to the next centimetre or inch.
- i. In the case of transport of vehicles, STANAGs 2153 and 2163 apply.

DEFINITIONS

3. a. *Shipping Containers*. This is a container which is sufficiently strong by reason of material, design and construction to be shipped safely without further packing either as a primary pack or as an outer container for consumer packages (interior containers). Examples: Wooden boxes or crates; fibre, plywood and metal drums; corrugated and solid fibre boxes in the remainder of this STANAG the word "container" is used); multi-wall paper shipping sacks; textile shipping bags, etc.

b. *Gross Weight*. The gross weight is to indicate the weight of the container and its contents, including all packaging material. The abbreviation for Gross Weight is WT.

c. *Outside Dimensions*. These are the external dimensions of the containers, including all projections ("overall" dimensions).

d. *Commodity Mark*. This is a symbol which broadly classifies the content of a container.

MOVEMENT MARKS AND LABELS

4. Subject to over-riding security considerations, the following movement marks and labels are to appear on containers as shown in Annex A(DofA). When a large

number of containers containing the same type of material are dispatched by one consignor, to one destination, providing they form part of a single consignment, only 10 % of the total number of containers need bear the markings specified. If the consignor so wishes, the unmarked containers may bear the identification number, followed by a serial number within the consignment:

a. Consigning Nation. The National Distinguishing Letters given in STANAG 1059 are to be placed OUTSIDE and to the LEFT of a rectangle containing the consignment Identification Number.

b. Identification Number. The consignment Identification Number, as laid down by the consigning nation, is to be contained in a rectangular frame.

c. Port of Discharge. The sea port or air port of discharge is to be shown in clear.

d. Consignee Unit. The consignee's address is to be shown in clear.

e. Weights and Dimensions. The following are to be marked on containers as appropriate and/or necessary:

(1) Gross Weight.

(2) Cube.

(3) Outside dimensions: Length, Width, Height. The only outside dimensions to be shown are for containers having any single dimension of 1.8 meters (72 inches) or more.

f. Container Numbers. Consignments consisting of a number of related containers are to be marked by the use of two numbers separated by an oblique stroke. The first number will indicate the individual container, the second will indicate the total number of containers (e. g. 6/12).

g. Priority Marks. The degree of national priority allocated to a consignment and the priority marks applied will be in accord with an internationally agreed system. In the absence of such an international priority system, the degree of priority desired will be indicated by the consignor, according to his own national system.

h. Commodity Identification. Commodity (item) identification will be by NATO Stock Number, Commodity Mark or nomenclature, in accord with the normal procedures of the consignor.

i. Special Cargo Labels. The labels specified in the International Conventions listed in the related documents are to be used for dangerous cargos.

HANDLING AND STORAGE INSTRUCTIONS

5. *a.* With regard to the handling and storage of consignments, no symbols are given in this instruction, as appropriate symbols are being adopted by the International Standards Organization (ISO). When these are ratified they will be issued as Annex B to the Details of Agreement of this STANAG.

b. The point of balance shall be marked by a vertical line not less than 3 inches (7.6 centimetres) long, painted from the bottom edge of both sides of containers over 10 feet (3 metres) in length or those which are unbalanced. The letters "C. G." shall be stencilled or printed immediately above or alongside of this mark.

LOCATION OF MARKS ON CONTAINERS

6. *a.* Commodity (item) identification is to be shown on one side and address markings are to be shown on the opposite side of containers with a volume equal to or less than 10 cubic feet (280 litres). Additionally, when the volume of the container is more than 10 cubic feet (280 litres), both commodity identification and address markings will be shown on the end of the container to the right when facing the side showing address markings. The opposite end and the top and bottom shall be used only for special cargo markings or labels required to be placed there by law, international agreement or regulations of the consignor, are necessary for safe handling. Other special cargo markings as required, to include handling and storage instructions not otherwise displayed, shall be shown on or attached to one side of the container, preferably the side showing commodity identification.

b. Containers which are non-parallel sided are to be marked in at least one location with commodity identification and address markings.

FM 55-70

c. The position of markings or labels is shown in Annex A(DofA) figures A to C. The detailed mandatory and optional composition of commodity identification and address markings is shown on the last page of Annex A(Dof A).

d. Where there are no surfaces suitable for stencilling, weatherproof tags or labels are to be used.

e. The position of the markings: weight (WT) and cubic capacity (CU) shown on the sketch attached to Annex A does not apply to ammunition packages. Details of ammunition markings are given in STANAGs 2316 and 2322.

DOCUMENTS

7. Documents and detailed lists of contents are to be firmly attached to the outside of at least one container, of any consignment, if the nature of the container permits. Otherwise the documents and lists are to be placed inside the container or containers.

IMPLEMENTATION OF THE AGREEMENT

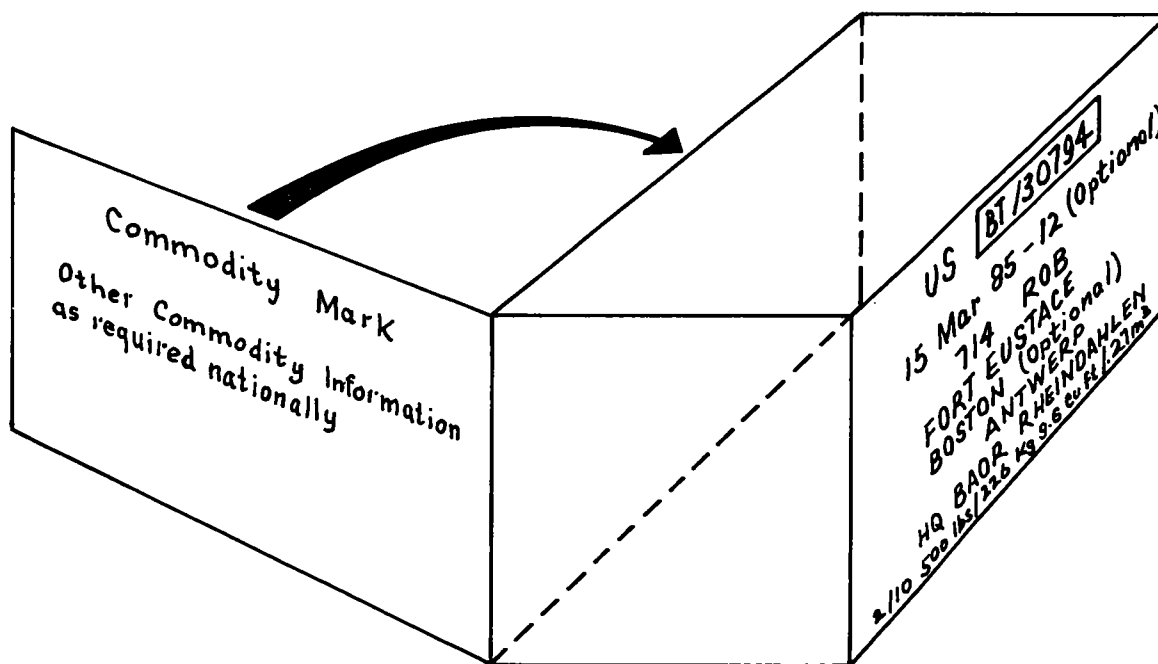
8. This STANAG will be considered to have been implemented when the necessary orders/instructions to adopt the method described in this Agreement have been issued to the forces concerned.

ANNEX A TO THE DETAILS OF AGREEMENT OF
STANAG 2023

LOCATION OF MARKS ON CONTAINERS

Fig. A

Container with volume up to 10 cu ft (280 litres)



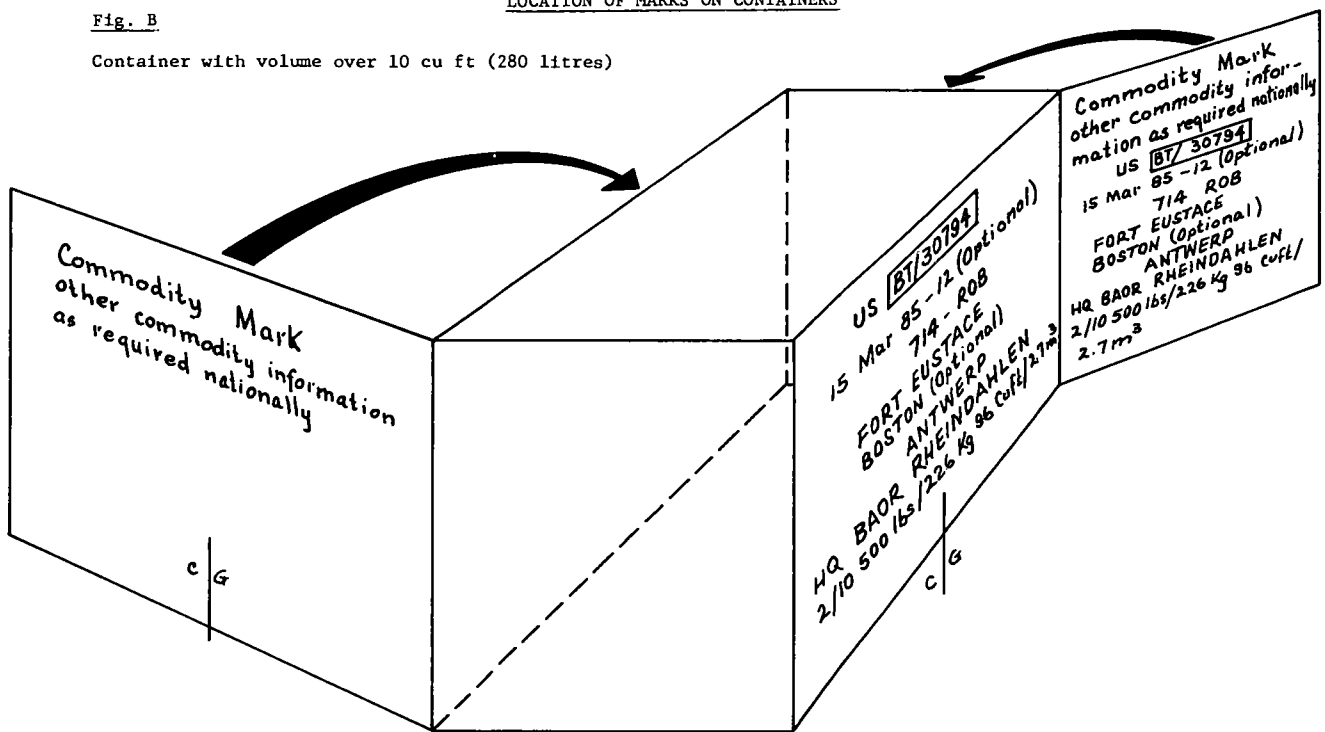
A(DofA) - 1

ANNEX A TO THE DETAILS OF AGREEMENT OF STANAG 2023

LOCATION OF MARKS ON CONTAINERS

Fig. B

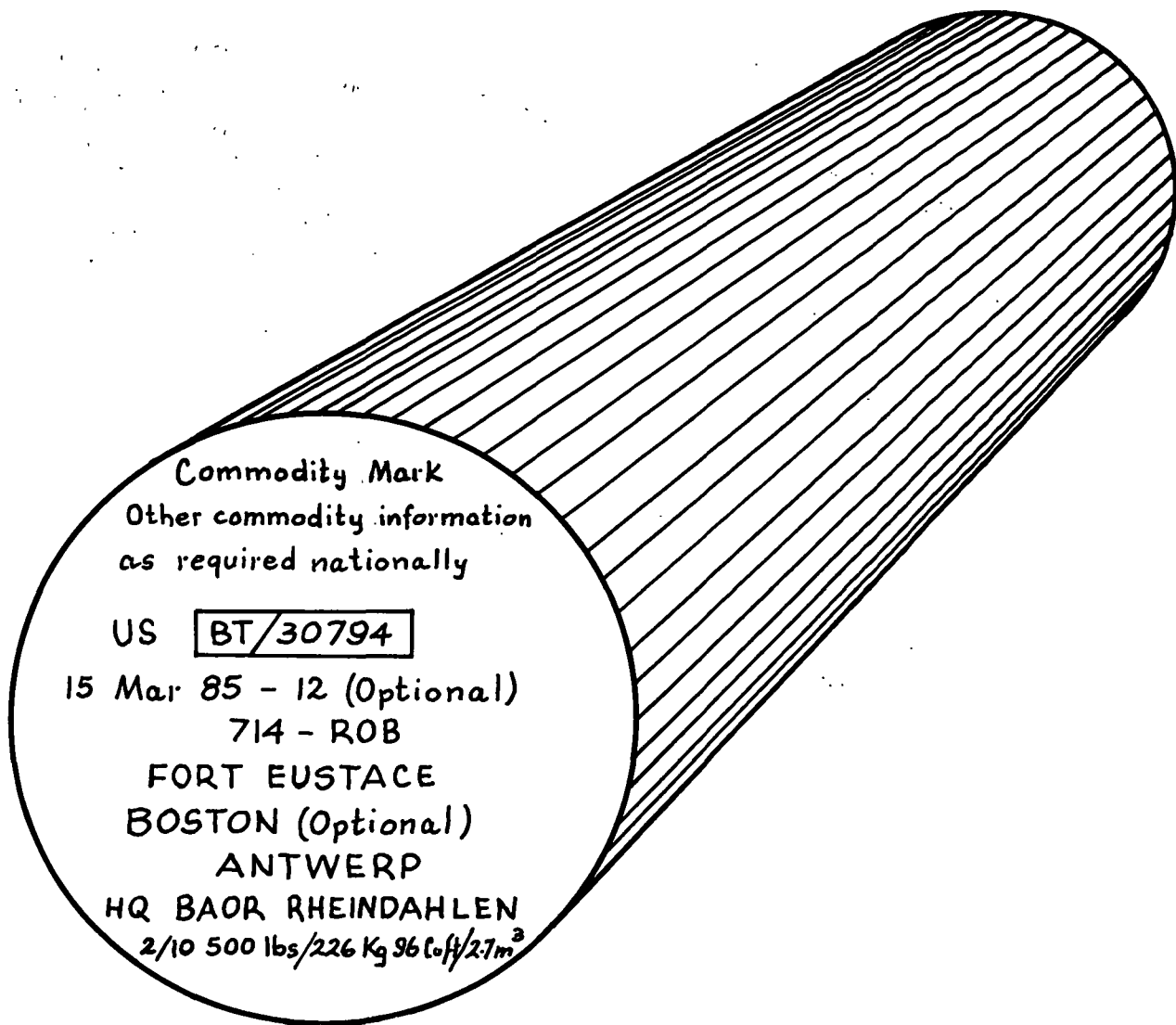
Container with volume over 10 cu ft (280 litres)



A(DofA) - 2

ANNEX A TO THE DETAILS OF AGREEMENT OF STANAG 2023Fig. C

Non-parallel sided container



"COMMODITY IDENTIFICATION" FORMAT

LINE 1 Commodity (item) Identification by nomenclature,
NATO Stock Number, and/or Commodity Mark
according to National System of consignor.
LINES 2, 3 etc. Other Commodity information as required
nationally.

"ADDRESS MARKING" FORMAT

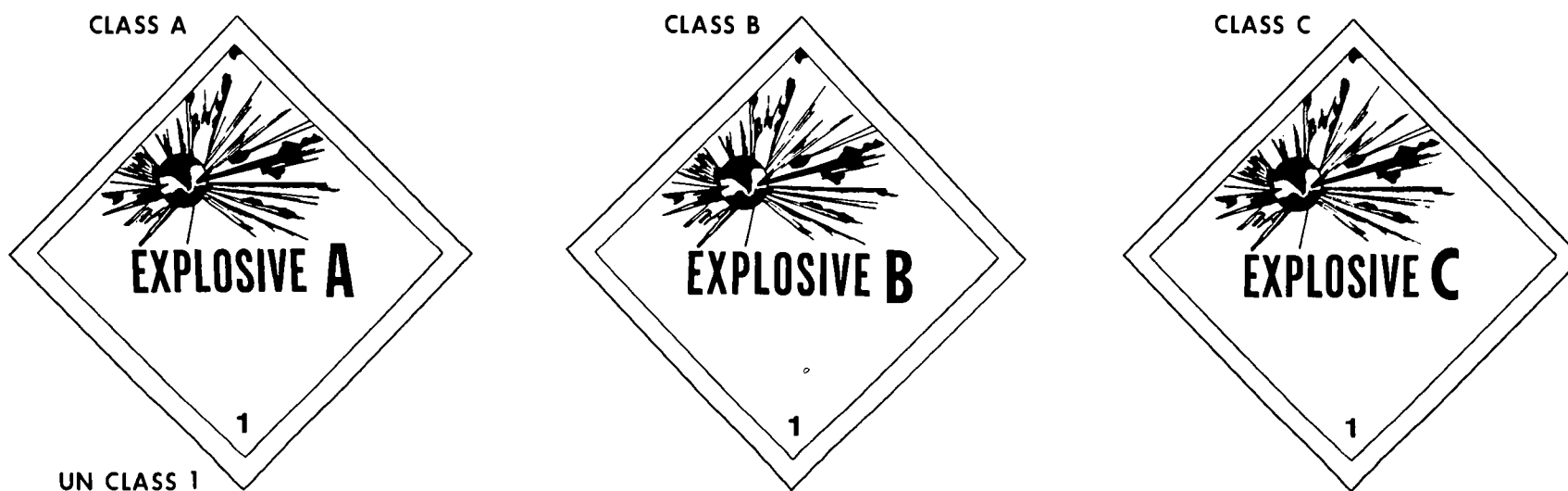
LINE 1 Consignment (Shipment) Identification Number.
LINE 2 Required Delivery Date and Project Code (optional)
and Priority Mark.
LINES 3 AND 4 From Consignor.
LINE 5 From Port of Embarkation (optional).
LINE 6 Via Port of Discharge (if applicable).
LINE 7 To consignee.
LINE 8 Unit Number, Total Units, WT each Unit, Cube
each Unit.

★ APPENDIX F

HAZARDOUS CARGO LABELS, TRUCK PLACARDS, AND RAIL PLACARDS

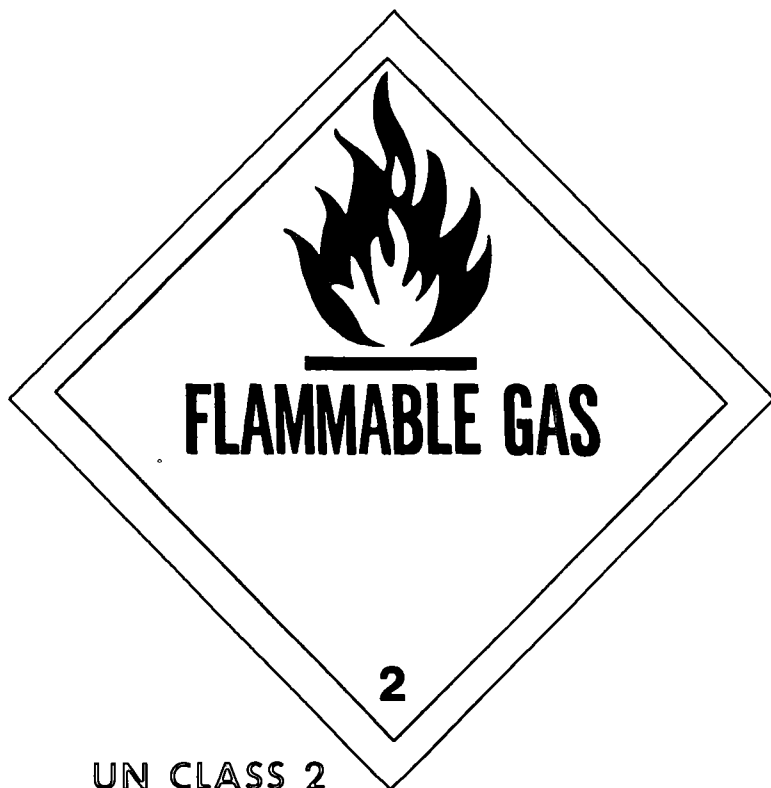
This appendix illustrates hazardous cargo labels, truck placarding charts, and rail placarding charts.

a. Hazardous cargo labels are shown in figures F-1 through F-14.



Note: All diamond shaped labels illustrated must be at least 4 × 4 inches and have a solid line border at least 3 1/2 inches long on each side.

Figure F-1. Explosives.



UN CLASS 2



Figure F-2. Compressed gases.



Figure F-3. Flammable liquid.

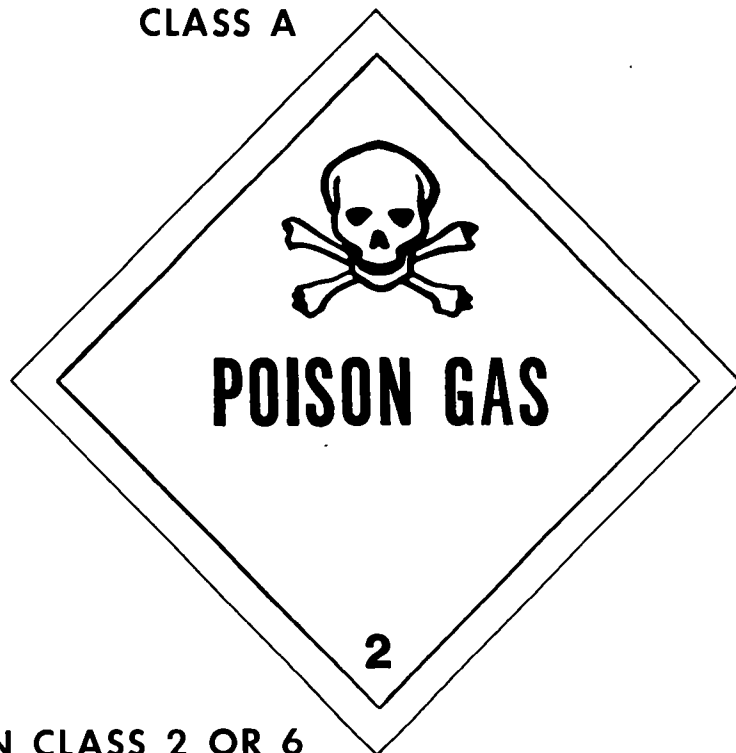


Figure F-4. Flammable solid.



Figure F-5. Oxidizing material.

CLASS A



UN CLASS 2 OR 6

CLASS B

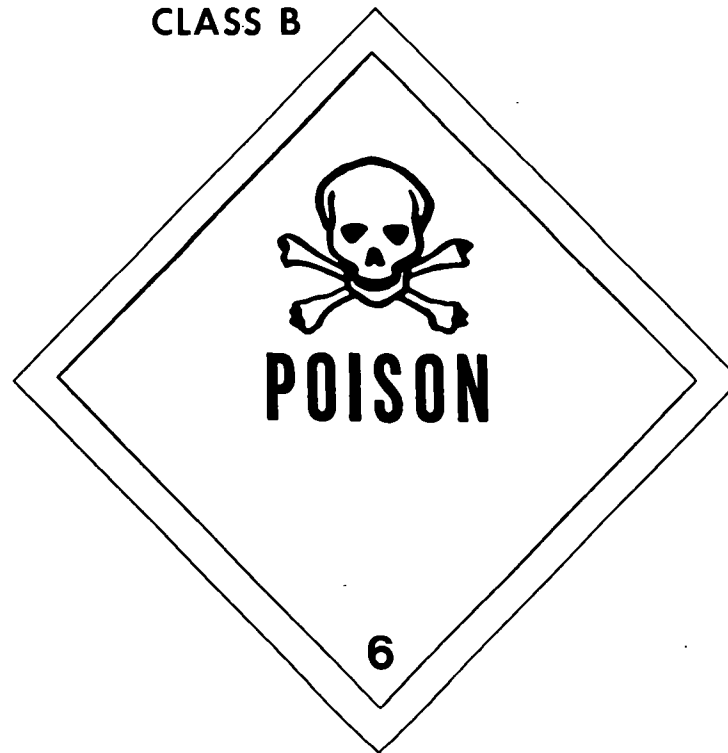


Figure F-6. Poisonous material.

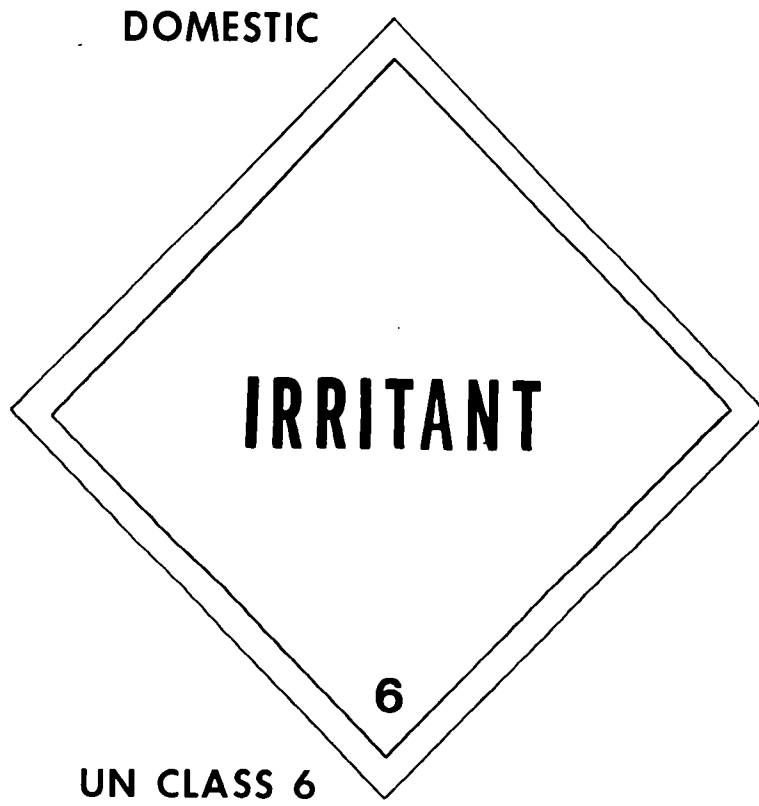


Figure F-7. Irritating material.



UN CLASS 7

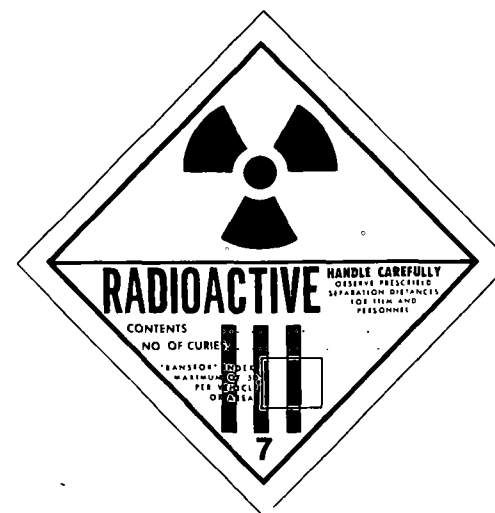
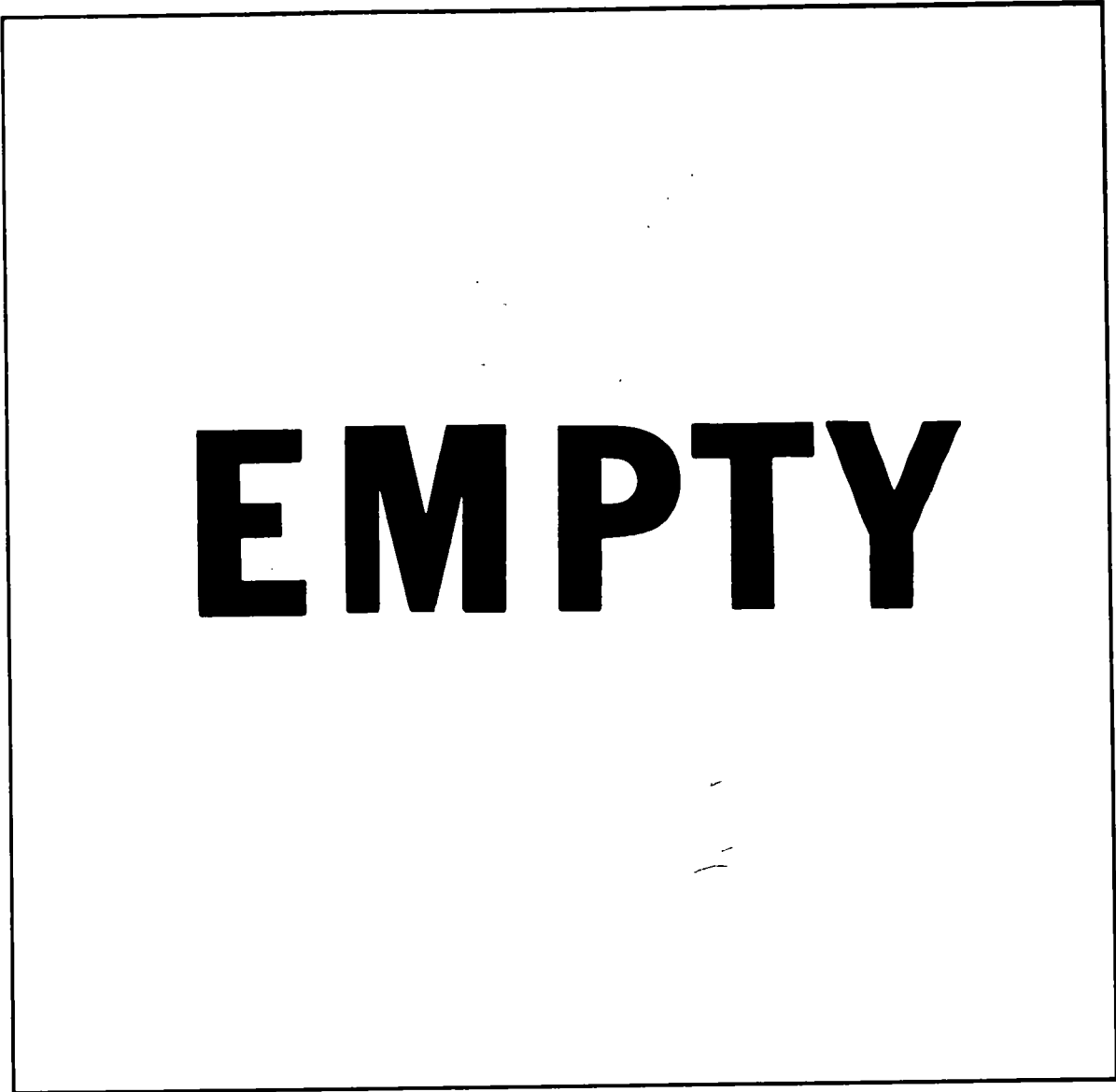


Figure F-8. Radioactive materials.



Figure F-9. Corrosive material.



EMPTY

(Actual size — 6"×6"(min.))

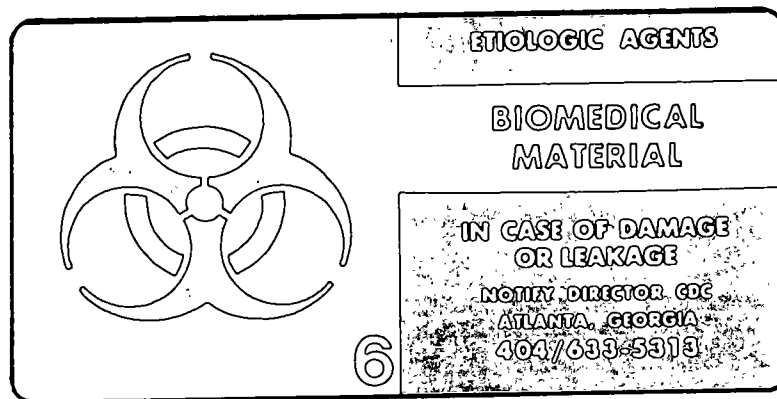
Figure F-10. Empty.

FOR EXPORT ONLY

SPONTANEOUSLY
COMBUSTIBLE MATERIALWATER-REACTIVE
MATERIAL

NOTE: For use in addition to other required labels.

Figure F-11. Optional labels.



Required for domestic shipments including the domestic portion of import and export movements.

Note: A Poison Label may be used on import/export shipments in addition to this label.

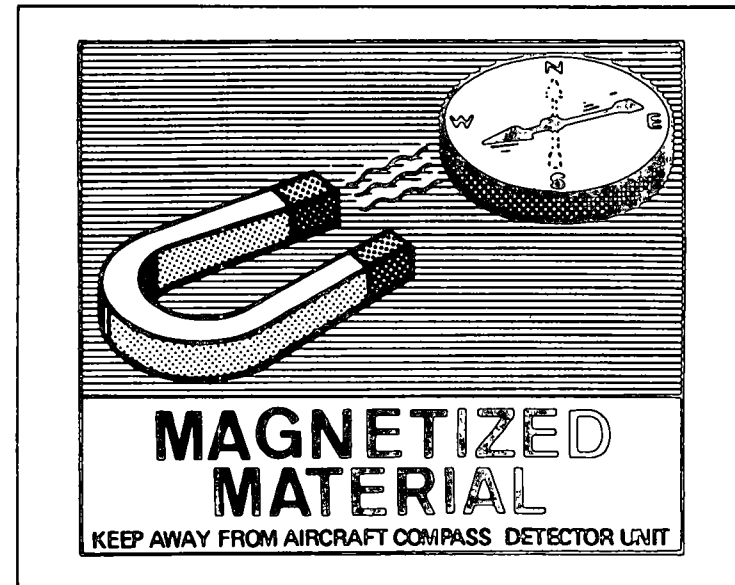
(Actual size — 4"×2")

Figure F-12. Etiologic agent.



CARGO AIRCRAFT ONLY

(Actual size — 4 11/32"×4 5/16")



MAGNETIC MATERIAL

(Actual size — 3 9/16"×4 5/16")

Figure F-13. Non-DOT labels for certain commodities when shipped by air.

CAUTION

**Unscrew This Bung
SLOWLY**

**Do not unscrew entirely until all
interior pressure has escaped through
the loosened threads.**

**REMOVE BUNG IN OPEN AIR. Keep
all open flame lights and fires away.
Enclosed Electric Lights are safe.**

(Actual size — 5"×3")

Figure F-14. Bung label.

b. Truck and rail placarding charts are shown in figures F-15 through F-31.



Note: Square black-bordered, white background required for rail transport of explosives A.

*Figure F-15. Explosives A—placard any quantity of explosives A or combination of A and B explosives.
See DANGEROUS for mixed loads.*



Figure F-16. Explosives B—placard any quantity of explosives B. Use EXPLOSIVES A placard if mixed with explosives A materials. For other mixed loads, see DANGEROUS.



Figure F-17. Nonflammable gas (compressed)—placard 1,000 pounds or more gross weight.



Figure F-18. Corrosives—placard 1,000 pounds or more gross weight of corrosive liquids.

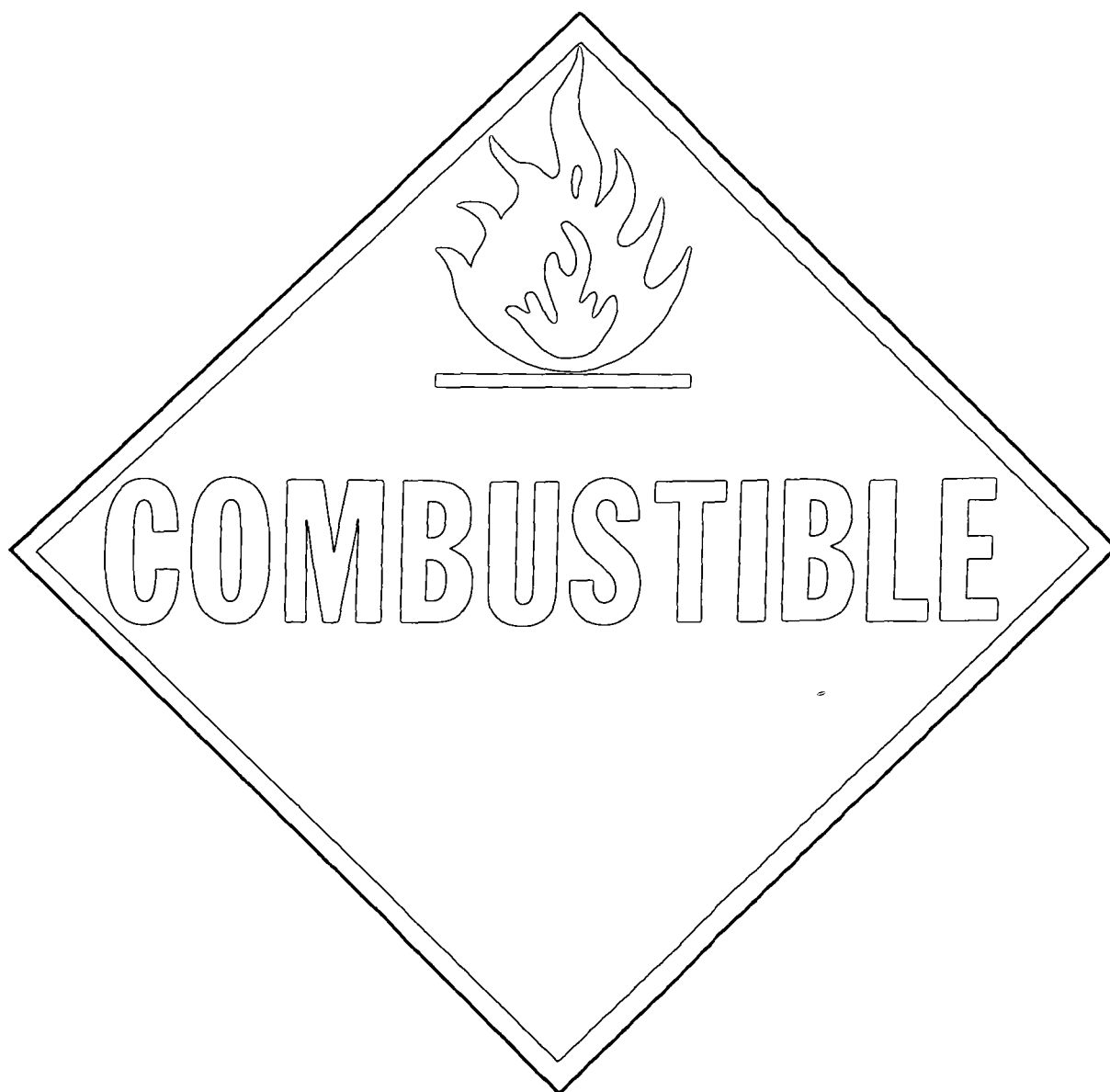


Figure F-19. Combustible—placard when packagings exceed 110-gallon rated capacity.



Figure F-20. Flammable solid (avoid water)—placard 1,000 pounds or more of flammable solids. Not allowed by water.



Figure F-21. Poison—Placard any quantity of poison A or a combination of poison A and B. Placard 1,000 pounds or more gross weight of poison B. For mixed loads, see DANGEROUS.



*Figure F-22. Flammable solid—placard 1,000 pounds or more of flammable solids, flammable liquids, or combination of both.
Combination of flammable solids and flammable liquids not allowed by water.*

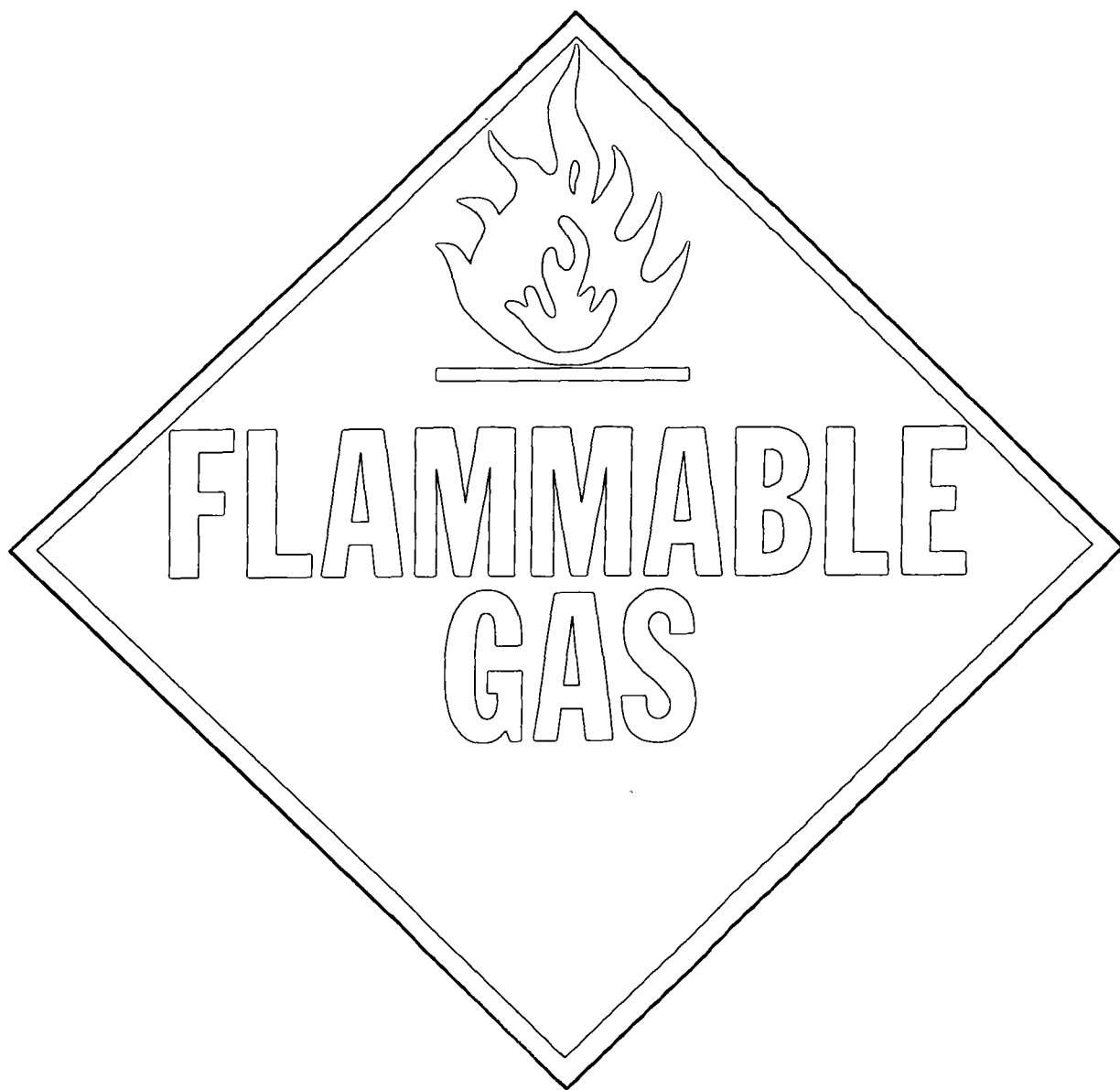


Figure F-23. Flammable gas—placard 1,000 pounds or more gross weight of flammable gas.

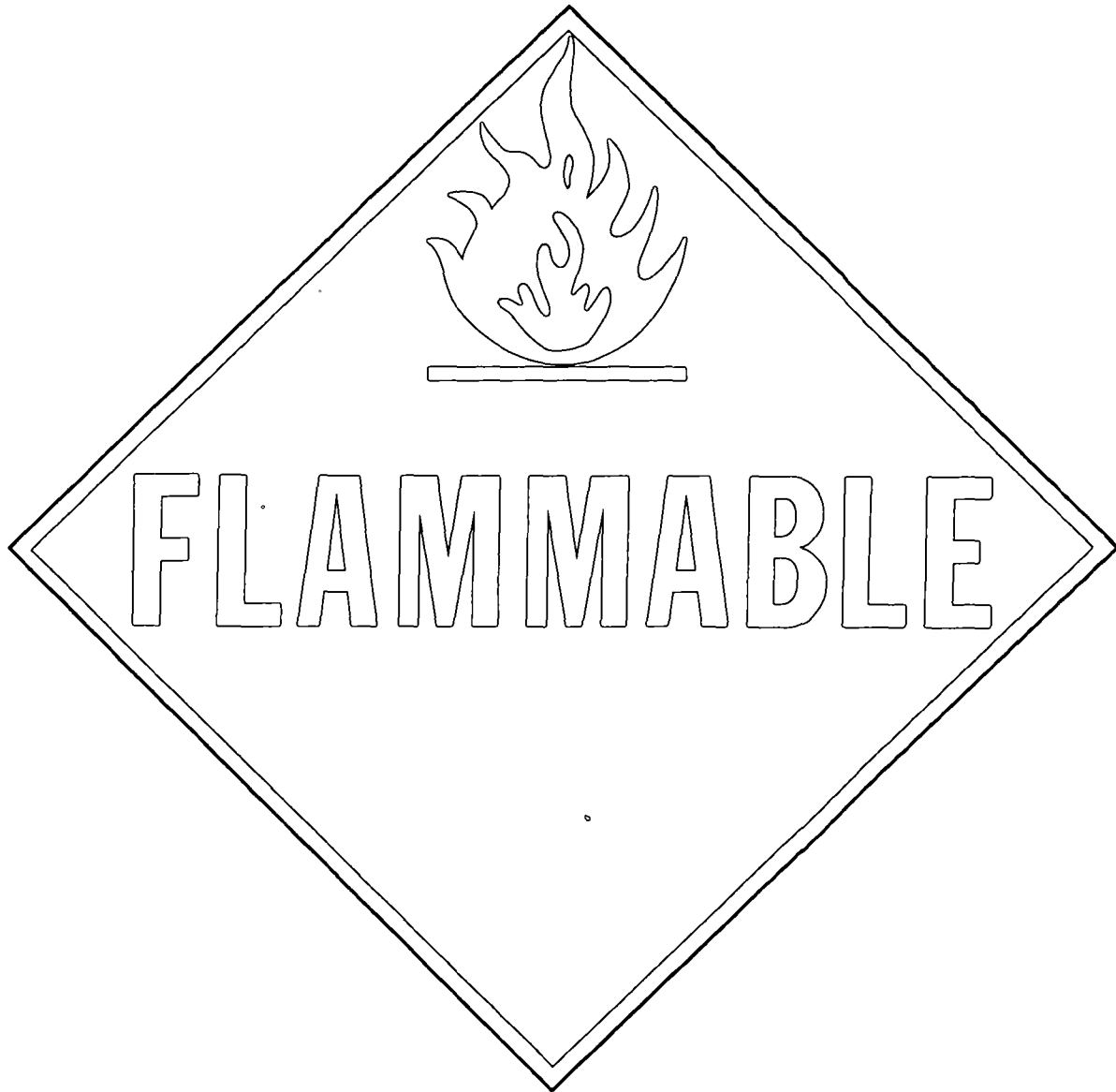


Figure F-24. Flammable—placard 1,000 pounds or more gross weight.



Figure F-25. Oxidizer—placard 1,000 pounds or more gross weight.



Figure F-26. Oxygen—placard 1,000 pounds or more gross weight.

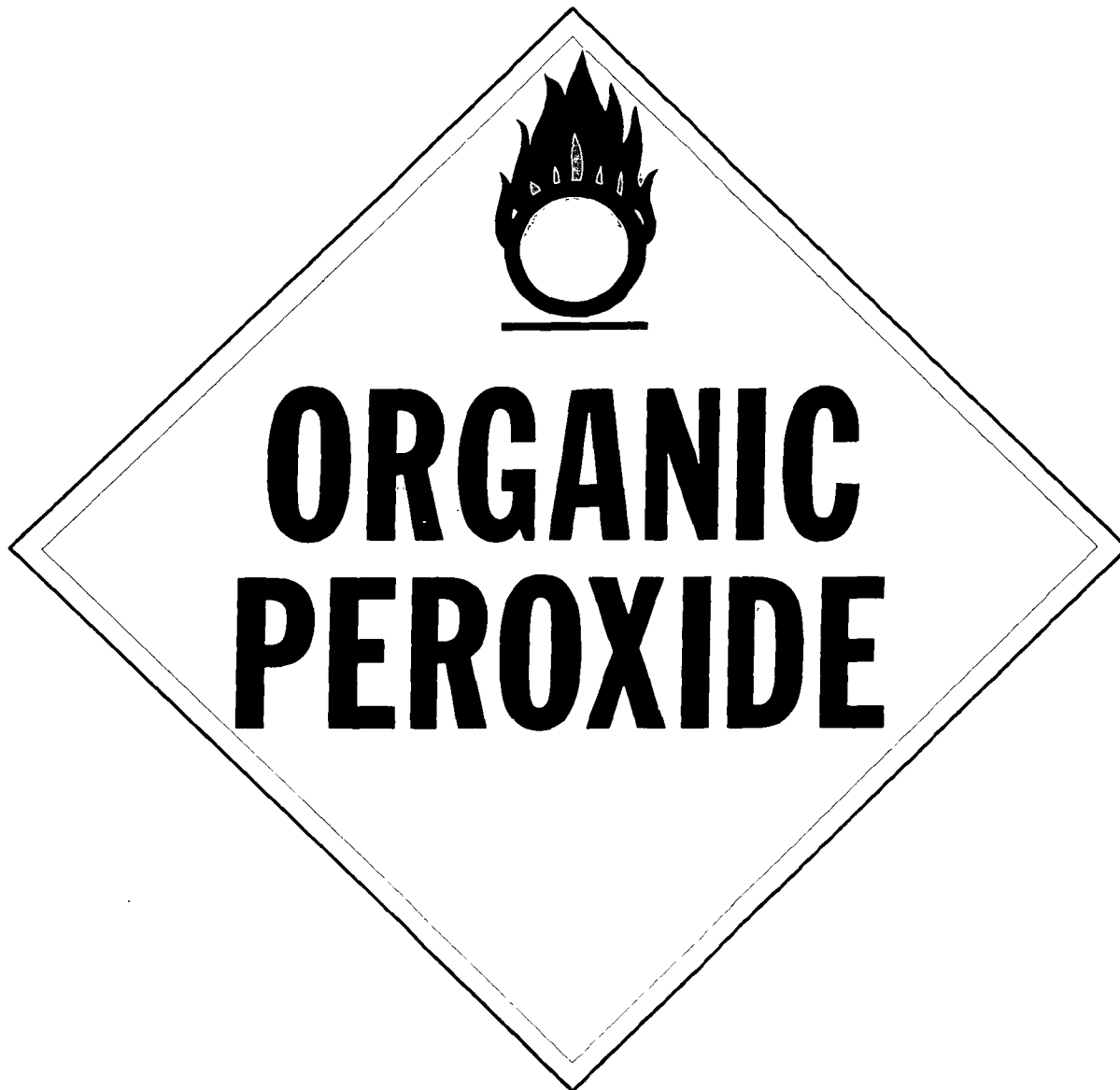
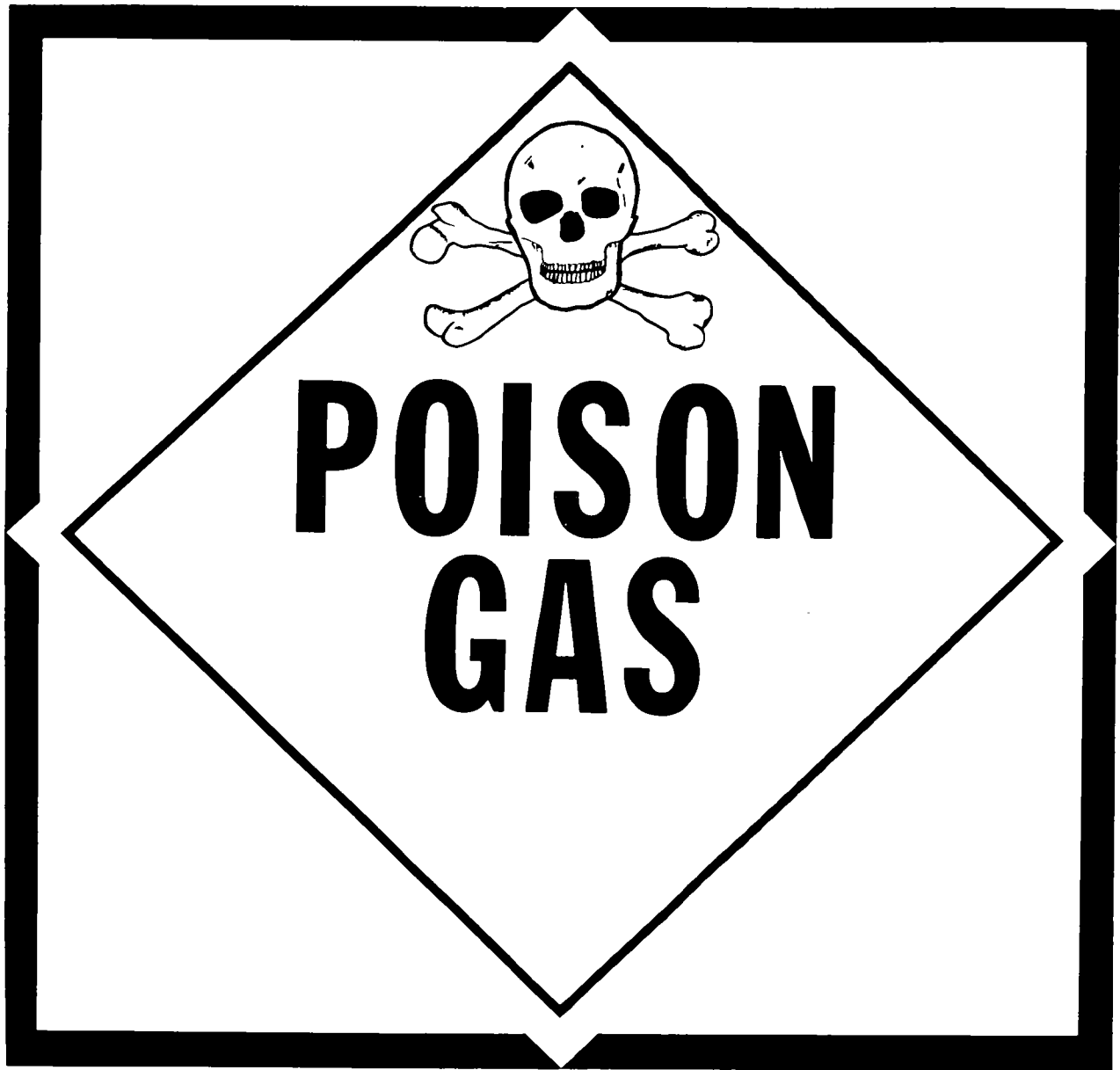


Figure F-27. Organic peroxide—placard 1,000 pounds or more gross weight.



Figure F-28. Chlorine—placard 1,000 pounds or more gross weight.



Note: Square black-bordered, white background required for rail transport of poison gas.

Figure F-29. Poison gas—placard any quantity.



Note: For mixed loads, see Table 1, 49CFR, part 172.504

Figure F-30. Radioactive —placard any quantity of shipment of radioactive material.



Note: Double placarding should be used when loads requiring the **DANGEROUS** placard are mixed with any quantity of the following commodities by adding the specific placard to the **DANGEROUS** placard:
Explosives A, Explosives B, Radioactive, and Poison A.

Figure F-31. Dangerous—use the DANGEROUS placard for mixed loads containing more than one kind of hazardous material requiring placards when the aggregate gross weight totals 1,000 pounds or more, and place appropriate labels beneath.





APPENDIX A

REFERENCES

References listed below were used in the development of this manual. Regulations governing transportation of dangerous cargo are listed in annex I to appendix B.

A-1. DOD Regulation

4500.32-R

Military Standard Transportation and Movement Procedures (MILSTAMP).

A-2. Army Regulations

55-1

CONEX Container Control, Utilization, and Reporting.

55-355

Military Traffic Management Regulation (NAVSUPINST 4600.70/AFM 75-2/MCO P4600.14A/DSAR 4500.3).

56-1

Ownership and Use of Containers for Surface Transportation and Configuration of Shelters/Special Purpose Vans (OPNAVINST 4620.8A/AFR 75-7/MCO 4600.30A).

220-10

Preparation for Oversea Movement of Units (POM).

A-3. Field Manuals

55-11

Army Movement Control Units.

55-20

Army Rail Transport Operations and Units.

55-30

Army Motor Transport Operations.

55-40

Army Combat Service Support Air Transport Operations.

55-50

Army Water Transport Operations (to be published).

55-60

Army Terminal Operations.

A-4. Technical Manuals

1-(Aircraft)-series

Manuals on preparation for shipment of individual aircraft.

38-230-1

Preservation, Packaging, and Packing of Military Supplies and Equipment (Volume I) (DSAM 4145.2, Volume I; NAVSUP Pub 502 (formerly NAVAIR 15-01-1); AFP 71-4, Volume I; MCO P4030.31).

38-230-2

Preservation, Packaging, and Packing of Military Supplies and Equipment (Volume II) (DSAM 4145.2, Volume II; NAVSUP Pub 503 (formerly NAVAIR 15-01-2); AFP 71-4, Volume II; MCO P4030.21A).

55-series

Manuals on air transport of supplies and equipment.

55-8115-200-24

Organizational, Direct, and General Support Maintenance Manual (Including Repair Parts and Special Tool List), Container, General Cargo: MILVAN, FSN 8115-168-2275; Container with Mechanical Load Bracing System: MILVAN, FSN 8115-151-9953.

A-5. Technical Bulletins

55-46-1

Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Other Outsize/Overweight Equipment (in TOE Line Item Number Sequence).

55-46-2

Standard Characteristics (Dimensions, Weight, and Cube) for Transportability of Military Vehicles and Equipment (in Federal Stock Number Sequence).

A-6. Tables of Organization and Equipment

1-118

Assault Support Helicopter Company (to be published).

1-167

Assault Support Helicopter Company, Assault Support Helicopter Battalion, Airmobile Division.

1-256H

Headquarters and Headquarters Company, Combat Aviation Battalion.

1-258H

Assault Support Helicopter Company.

FM 55-70

1-259G	Aviation Heavy Helicopter Company.
19-97G	Military Police Physical Security Company.
54-22G	Headquarters and Headquarters Company, Army Support Brigade, or Headquarters and Headquarters Company, Corps Support Brigade, or Headquarters and Headquarters Company, Corps Support Command.
55-2H	Headquarters and Headquarters Company, Transportation Command.
55-4H	Transportation Movement Control Agency.
55-7H	Transportation Movement Control Center (Corps Support Brigade).
55-17G	Transportation Light Truck Company.
55-18G	Transportation Medium Truck Company.
55-19G	Transportation Car Company, Support Command or Airborne Corps.
55-28G	Transportation Heavy Truck Company.
55-52H	Headquarters and Headquarters Company, Transportation Composite Group.
55-62G	Headquarters and Headquarters Company, Transportation Brigade, Corps Support Command.
55-67G	Transportation Light-Medium Truck Company.
55-84H	Transportation Motor Transport Company, Supply and Transport Battalion, Infantry Division, Mechanized.
55-87H	Transportation Motor Transport Company, Supply and Transport Battalion, Armored Division.
55-88H	Transportation Motor Transport Company, Supply and Transport Battalion, Infantry Division.
55-111G	Headquarters and Headquarters Company, Transportation Terminal Brigade.
55-112G	Headquarters and Headquarters Company, Transportation Terminal Group.
55-116G	Headquarters and Headquarters Company, Transportation Terminal Battalion.
55-117G	Transportation Terminal Service Company.
55-117H410	Transportation Terminal Service Company (Break-Bulk).
55-117H420	Transportation Terminal Service Company (Container).
55-118G	Transportation Terminal Transfer Company.
55-118H	Transportation Terminal Transfer Company.
55-128G	Transportation Medium Boat Company.
55-129G	Transportation Heavy Boat Company.
55-138G	Transportation Light Amphibian Company.
55-139G	Transportation Medium Amphibian Company.
55-259H	Heavy Helicopter Company.
55-530G	Transportation Watercraft Teams.
55-540G	Transportation Motor Transport Teams.
55-560G	Transportation Terminal Service Teams.
55-580G	Transportation Movement Control Teams.

A-7. Department of the Army Pamphlets

310-1 through 310-8	Indexes for Military Publications.
310-35	Index of International Standardization Agreements.
700-22	Direct Support System (DSS).

A-8. Department of Defense Forms

173	Joint Messageform.
1384	Transportation Control and Movement Document (TCMD).
1385	Cargo Manifest.
1387-1	Military Shipping Tag.
1750	Packing List.

A-9. Department of the Army Form

2028

Recommended Changes to Publications and Blank Forms.

A-10. Other

CONARC Movement Planning and Status System (COMPASS), Equipment Characteristics Data (Dimensions, Weight, and Cube)—Vehicles and Outsize/Overweight Items Only.
USATEA Report 71-39, Utilization of Flat Racks in Force Deployments, November 1971.
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GLOSSARY

American National Standards Institute (ANSI)—A non-Government organization established by the various trades to provide uniformity in the characteristics of consumer goods. The ANSI MH-5 committee was formed in 1958 to establish specifications and the basis for standard size containers for use in the United States. ANSI, the headquarters of which is in New York City, provides US representation with the International Organization for Standardization (ISO).

Asset visibility—See in-transit asset visibility.

Break-bulk point—A transshipping activity to which multiple shipment units may be consigned for further distribution within the transportation system.

Break-bulk ship—A ship with conventional holds for storage of noncontainerized general (break-bulk) cargo below or above deck, and equipped with cargo handling gear. Ship may also be capable of carrying above or below deck a limited number of containers secured by conventional methods.

Cellular construction—As applied to a container ship, vessel is fitted with vertical guides into which a container fits and which constrain it at the eight corners. Containers are stacked one above the other, with the bottom container taking the vertical load resulting from those resting on it. The entire load is transferred through the cornerposts of the containers to a reinforced doubling plate on the tank top or on the bottom of the hold.

Consolidation and distribution point—An exclusive or common-use facility located in CONUS or in a theater of operations. It is charged with the responsibility of receiving small lot shipments for consolidation or consolidated shipments for breakout and shipment to small lot users.

Container—An article of transport equipment having an interior volume of 400 cubic feet or more and designed to facilitate and optimize the carriage of goods by one or more modes of transportation without intermediate handling of the contents. It is equipped with features permitting its ready handling and transfer between modes. Containers may be fully enclosed with one or more doors, open top, tank, refrigerated, open rack, gondola, and other designs. Included in this definition are modules or clusters so configured that they can be

coupled to form an integral unit with an internal capacity of 400 cubic feet or more, whether moved singly or in multiplex configuration.

Containerization—The use of containers to unitize cargo for transportation, supply, and storage. Containerization incorporates supply, security, packaging, storage, and transportation into a distribution system from source to user.

Container on flatcar (COFC)—The system in which containers (less trailer) are transported on railway flatcars.

Container systems—Aggregations of military and/or commercial hardware and software employed in intermodal transport of containers and their contents from origin to destination. Container systems include some or all of the following components: containers; highway, rail, ocean, and air transport equipment; container handling equipment; and systems management equipment and procedures, including cargo accounting and documentation. Container systems may be dedicated to specific classes or commodities or to selected modes, or they may be for general cargo distribution.

Cube out—As applied to stowing of containers, the maximum cubic capacity of the container is reached before the maximum weight capacity.

Destination—The point at which container movement ceases. It may be the ultimate user or consumer of the container lading, a retail supply point, or a consolidation and distribution point in the theater of operations.

Direct support system—A supply support system designed to provide palletized (air) and containerized (surface) support to oversea general support units and direct support units directly from designated depots or container consolidation points in CONUS, bypassing theater depots and break-bulk points: a required feature of inventory in motion.

Direct support supply activity (DSSA)—A term applied to direct support supply units.

Fixed port terminal—An established shoreside installation at which passengers and/or cargo are transshipped between oceangoing ships and inland transport equipment.

Full container ship—A ship specially constructed and equipped to carry only containers without associated equipment in all available cargo spaces, either below or above deck. The ship

may or may not have a container load/discharge capability.

General support supply activity (GSSA)—A term applied to general support supply units. Under certain conditions, grouping of GSSA's may constitute a depot complex.

Intermodal transport—The capability of interchange of ANSI/ISO standard containers among the various mode items of transport.

International Organization for Standardization (ISO)—An international body representing over 50 national committees in promoting the development of standards on a worldwide basis. The purpose of ISO is to facilitate international exchange of goods and services and to develop mutual cooperation in the areas of intellectual, scientific, technological, and economic activity. ISO has published standards for dimensions, ratings, and construction of freight containers. The headquarters of ISO is in Geneva, Switzerland.

In-transit asset visibility—The capability of identifying and accounting for items in transit in the military pipeline, both as to time and location: a required feature of inventory in motion.

Inventory in motion—1. That portion of the total supply inventory, both serviceable and un-serviceable, that is in transit in the military pipeline.

2. A logistics concept aimed at reducing the quantity of items in the DOD inventory by replacing shelf storage with a more responsive requisition/distribution system.

Lighter aboard ship (LASH)—A specially constructed ship in which barges serve as the ship's holds. A self-contained crane loads and offloads the barges, which may be towed between pier and ship by tug. Certain LASH vessels are also equipped with shipboard container cranes and can handle a number of 20-foot containers. The capability can be increased by shipyard conversion.

Logistics over-the-shore (LOTS) operation—The loading and unloading of ships without benefit of fixed port facilities. The operation is conducted in friendly or nondefended territory or, in time of war, during phases of theater development in which there is no opposition by an enemy.

Mobile port—A temporary port established by Department of the Army orders or other competent authority. The organization may be transferred intact with equipment and supplies to another area for the purpose of establishing a new mobile port.

Multipurpose ship—A conceptual self-sustaining ship capable of handling containers; roll-

on/roll-off, break-bulk, and heavy lift cargo; non-self-deployed aircraft; helicopter fly-on/fly-off; and LCU type landing craft.

Non-self-sustaining container ship—A container ship having no (or extremely limited) self-loading/unloading capability.

Origin—1. A commercial vendor or military or other Government supply source in CONUS or a shipping activity located overseas. 2. The beginning point of a shipment.

Partial container ship—A ship with a portion of its cargo space specially designed and equipped for the exclusive carriage of containers (less chassis); the remainder of the cargo space is available for noncontainerized cargo. The ship may or may not have a container load/discharge capability. Also referred to as semi-container ship.

Piggyback—See trailer on flatcar.

Point-to-point transportation—As applied to containers, indicates that the use of the container is limited to transportation and that the container is normally stowed and unstowed within the free time allowed by the carrier (or, for military owned or leased containers, by theater policy) for return of the container to carrier's control.

Port/terminal facility—A commercial or military facility at which container shipments are loaded/discharged; includes offshore discharge sites.

Roll-on/Roll-off (RORO)—Ocean shipping in which vehicles (wheel and/or track) are driven aboard a special vessel, secured for the voyage, and driven off at destination port; used for cargo and unit moves.

Sea barge (SEABEE)—Similar in concept to the LASH (defined above); can also be converted to a container ship.

Self-sustaining container ship—A container ship equipped with shipboard cranes that give the ship a self-loading/unloading capability.

Semi-container ship—See partial container ship.

Stowing—The packing of cargo into a container.

Surface container-supported distribution system—A distribution system that uses surface modes of transport for containers, including (for purposes of this manual) rotary wing aircraft.

Throughput distribution—A term used to describe shipments which bypass intermediate installations.

Trailer on flatcar (TOFC)—The system in which complete highway truck trailers or containers on chassis are moved by railway flatcars.

Transfer point—A point at which containers transfer between modes of transportation or between responsible transporting units.

Trans-hydro craft—Trans-hydro craft are craft that float on the surface of the water; are supported above the surface of the water by an air cushion, foil, or other means; or fly over a body of water. They can also possess land mobility. Trans-hydro craft are used by the Army in lighterage operations, in coastwise and inland waterway operations, in harbor service, and in other roles in which mobility over bodies of water is required.

Unstowing—The removal of cargo from a container.

Visibility of assets—See in-transit asset visibility.

Weigh out—As applied to stuffing of containers, the maximum weight capacity of the container is reached before the maximum cubic capacity.



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Distribution:

ACTIVE ARMY, ARNG, USAR: To be distributed in accordance with DA Form 12-11B requirements for Army Transportation Services in a Theater of Operations (Block 387); Transportation Amphibian Operations (Block 394); Army Terminal Operations (Block 398).

★ U.S. GOVERNMENT PRINTING OFFICE: 1975-603-173 / 5028



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required to familiarize personnel with this equipment, particularly in stacking and unstacking containers in association with all modes of transport equipment.

- **Cargo handling**—A knowledge of how containers are handled during both fixed port and LOTS operations is required. Training is required in use of the various types of container slings and spreader bars. Actual exposure to hookup and unhooking procedures must be provided. Securing containers to various transport modes is also a requirement. Additionally, the cargo handler must be trained in responsibilities related to directing crane operations in the spotting of containers.

- **Maintenance of equipment**—School training is required for personnel assigned to the container equipment maintenance section, particularly in the areas of container materials handling equipment and container maintenance and repair.

Augmentation:

The capabilities of the transportation terminal service company (container) are based on requirements of an average port in a theater of operations. Actual operating conditions encountered may require additional personnel and equipment capabilities. For such a contingency, additional teams with a container handling capability are being developed in a new TOE 55-560, Transportation Terminal Service Teams.

5-5. Transportation Terminal Transfer Company

The additional requirement of handling containers does not affect the organizational structure of the transportation terminal transfer

company (TOE 55-118). However, the mission has been modified and suitable container handling equipment has been authorized to give the company the dual capability for handling containers and general cargo.

Mission:

- To transship containers and break-bulk cargo at Army air, rail, highway, and inland barge terminals.

- To transship containers and break-bulk cargo transported by Air Force aircraft, as required.

Capabilities:

At level 1, the transportation terminal transfer company can—

- Transship 600 containers, or 900 short tons of break-bulk cargo daily, or a combination of both.

- As required, redocument transshipped cargo.

- Stow/unstow container contents on a limited basis.

- Operate at three separate terminals on an around-the-clock basis, in which case each terminal can transship 200 containers or 300 short tons of break-bulk cargo per day.

Assignment:

Normally assigned to a theater army or to a corps support command (COSCOM). Normally attached to a transportation command (TRANSCOM) in the theater army or to a transportation group or brigade in the COSCOM. May be attached to a motor transport group, a terminal group, or an aviation group as required.

Organization:

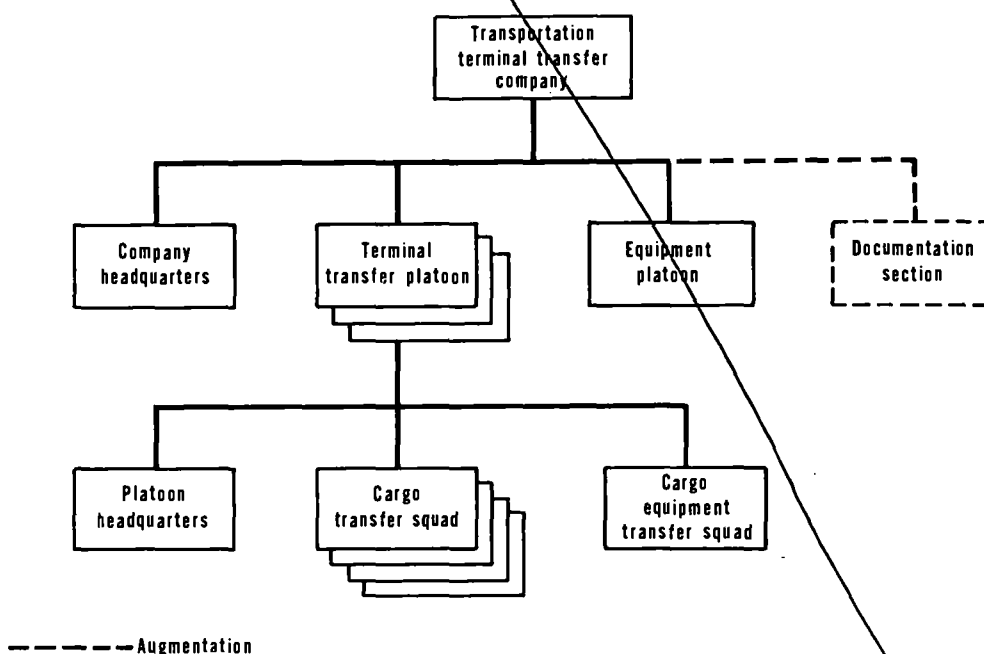


Figure 5-5. Organizational chart for the terminal transfer company (TOE 55-118)

FM 55-70

The transportation terminal transfer company consists of three terminal transfer platoons, an equipment platoon, and a company headquarters. A documentation section may be attached when required.

Operations:

The company is structured so that each of its three operating platoons can work independently and may be employed simultaneously at separate terminals. For example, one platoon can be operating at an inland waterway terminal, another at an air terminal, and a third at a rail-highway terminal transfer point.

When elements of less than platoon size are needed, the required number of cargo transfer squads and necessary equipment can be detailed to other terminals or transfer points for short periods.

The terminal transfer company is not normally assigned to operate a distribution point. However, if the cargo backlog indicates a requirement, the company or its elements may be temporarily committed in support of supply units performing distribution functions, to include unstowing container contents and otherwise readying the shipment for release by the movement control activity.

Each platoon headquarters has an organic documentation capability; when this is insufficient, an augmentation documentation section is authorized. This authorization provides a unit capability to receive, hold in transit, consolidate, and transship up to 200 shipments of less-than-carload or less-than-truckload size or 50 containers of incoming and retrograde material per day on an around-the-clock basis.

Major Items of Equipment:

Chapter 3 provides a detailed treatment of the materiel needs of a terminal transfer company

employed in container operations. Listed below are major types of equipment, number required, and assignment within the company:

- 6 container frontloaders, rough terrain, 50,000-pound-capacity (2 per terminal transfer platoon)
- 6 forklift trucks, 15,000-pound-capacity, rough terrain (2 per terminal transfer platoon)
- 6 low mast forklift trucks, 2,500/4,000-pound-capacity (2 per terminal transfer platoon)
- 3 mobile cranes for handling 20- to 40-foot containers (1 per terminal transfer platoon)
- 3 mobile ramps (1 per terminal transfer platoon)
- 6 semitrailers, dual purpose breakbulk/container transporter, 22½-ton, tactical (2 per terminal transfer platoon)
- 6 tactical military truck tractors (2 per terminal transfer platoon)

The type of crane required must have a capability of handling 20- and 40-foot containers, normally at 25- to 35-foot reach. It will replace the 20-ton wheel crane now authorized in the company.

The 50,000-pound-capacity rough terrain frontloader is required to transfer the 20- and 40-foot container from one mode of transport to another and to stack containers for temporary in-transit storage.

The 15,000-pound-capacity rough terrain forklift is required to provide a container handling capability for the TRICON and CONEX containers.

Training Requirements:

School training requirements for personnel of the transportation terminal transfer company parallel those for the transportation terminal service company (para 5-4).

Section III. TYPES OF TERMINAL OPERATIONS IN A THEATER OF OPERATIONS.

5-6. General

It can be anticipated that the following types of terminal operations will be required to support a theater of operations:

- Port terminal operations:
 - Fixed port
 - Mobile/portable port
- LOTS operation
- Inland terminal operations serving air and surface modes

5-7. Fixed Port

Statistical data based on Vietnam experience, as well as historical data from other past engagements, reveal that approximately 95

percent of all dry cargo is transported intertheater by ocean shipping. With the added emphasis on surface container usage, it is reasonable to believe that this percentage will continue to be valid. Although military container operations at fixed ports have been handled primarily by commercial operators, some experience has been gained by transportation terminal service companies employed at such ports in container operations.

Fixed port terminals are established shoreside installations which provide the facilities for interface between oceangoing ships and land transport equipment. They may vary in size from large deepwater complexes containing a number

CHAPTER 7

MARSHALING YARD OPERATIONS

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